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ABSTRACT

Twenty-four papers prepared for a conference on Piagetian theory and its implications for the helping professions are included in this report. The conference included the following symposia: (a) Present Status of Formal Operations, (b) Implications of Piaget for the Development of Curriculum, (c) Arithmetic and the Development of Logical Abilities, (d) Development of Moral Judgment in Children, (e) Piaget and Vygotsky, (f) Cognitive Growth and Language, (g) Piaget and the Early Education of Handicapped Children, (h) Piaget and the Development of Reading Ability, and (i) Piaget and Psychometric Assessment. (HMD)

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THIRD INVITATIONAL INTERDISCIPLINARY SEMINAR

PIAGETIAN THEORY AND ITS IMPLICATIONS FOR THE HELPING PROFESSIONS

FEBRUARY 16, 1973

UNIVERSITY OF SOUTHERN CALIFORNIA

CO-SPONSORED BY UNIVERSITY AFFILIATED PROGRAM*
CHILDRENS HOSPITAL OF LOS ANGELES AND THE
USC SCHOOL OF EDUCATION

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Preface and Welcome

Dean Irving R. Melbo
School of Education
University of Southern California

At this, the third Annual Piagetian Conference co-sponsored jointly by the School of Education of the University of Southern California and the University Affiliated Program at Los Angeles Childrens Hospital, I want to talk a moment on a few related items. I have had an interesting kind of indirect acquaintance with Dr. Piaget for a number of years. I recall the first time he spoke at USC quite a few years ago. Dr. Piaget was scheduled to speak in Bovard Auditorium which is quite a large auditorium. I was worried that there would be only a sparse audience. To my surprise, there were something like 1800 people present, despite the minimum publicity the lecture was given. In fact, the auditorium was full and some people were standing. Looking at the overcrowded auditorium, I realized how intensely admired and well known he was. Dr. Piaget lectured in French with an interpreter, and even if something was lost in the interpretation process, I am sure the audience went away well pleased.

Some years later I wrote to Dr. Piaget at the University of Geneva inquiring if he might be available to come as a Visiting Professor to give a series of lectures. His response was prompt and courteous, but he said he could not be available until 1975, and possibly not then. In 1972 I made a visit to the University of Geneva and at that time I was informed by Dr. Piaget that he was so deeply involved in his work that it was impossible for him to make a firm commitment which would take him away from it. I did still hope it might be possible to have Dr. Piaget on this campus again, but lacking such personal participation, this conference is the best possible alternative.

I am pleased that this is the third of such annual conferences, and I have been impressed by the significance of the program and by the nationwide response to it. It is a privilege to welcome you to this conference, and I am certain that your participation will be well rewarded.

We wish to thank all who helped make this conference successful – especially Melinda Kane for handling many of the administrative details and Michelle A. Giuliano for helping with the editorial tasks.

PROGRAM

A.M. FILM SESSION – EDISON AUDITORIUM

The following three films demonstrate PIAGET'S DEVELOPMENTAL THEORY.

8:30 CONSERVATION (28 min); FORMAL THOUGHT (32 min); CLASSIFICATION (17 min)

Films available from: Davidson Films, 3701 Buchanan St., San Francisco 94123

10:15	OPENING SESSION	Greetings: Dean Irving R. Melbo, USC School of Education Introduction of Speaker – James F. Magary, Ph.D., Director of Training in Education, UAP, Children's Hospital of Los Angeles, and Professor of Educational Psychology and Special Education, USC
	Speaker:	Mary Ann Pulaski, Ph.D., School Psychologist, Herricks Public Schools, Long Island, New York, Author of: *Understanding Piaget* (Harpers, 1971)
	Topic:	"IMPORTANCE OF LUDIC SYMBOLISM (MAKE BELIEVE PLAY) IN COGNITIVE DEVELOPMENT"
	Reaction Panel:	Chair Person – Gerald Lubin, M.D., Assistant Professor of Psychiatry and Pediatrics, USC, Assistant Program Director, UAP, Children's Hospital of Los Angeles
		Yvonne Hansen, Ph.D., Psychologist, Department of Psychiatry, Cedars Sinai Medical Center.
		C. Edward Meyers, Ph.D., Professor of Educational Psychology, USC
		Priscilla Wong, OTR, Adjunct Assistant Professor of Occupational Therapy, USC
12:00-1:30	MODERATOR –	Gerald Hasterok, Ph.D., Chairman, Special Education, USC
	Speaker:	Wallace R. Muelder, Ed.D., Associate Dean, USC School of Education
	Topic:	"CAN THE SCHOOL BE A CLINIC? SHOULD IT?"

AFTERNOON PROGRAM 1:30 - 3:30
SYMPOSIA, PAPERS, FILMS

PRESENT STATUS OF FORMAL OPERATIONS:

Co-chair Persons: Elizabeth Neumann, Ph.D., Fellow in Clinical Psychology, UAP, Children's Hospital at Los Angeles, Richard Brown, Ph.D., Director of Training in Psychology, University Affiliated Program, Children's Hospital at Los Angeles, Assistant Professor of Pediatrics, USC

Robert J. Ross, Department of Educational Psychology, Mississippi State University, State College, Mississippi

"The Empirical Status of Formal Operations"

Richard L. Kimball, Ph.D., Assistant Professor, Teacher Education, California State University at Hayward

"Teaching and Understanding of Formal Operations"

Robyn M. Dawes, Ph.D., Professor of Psychology, University of Oregon

"An Interpretation of some of Inhelder's and Piaget's Findings"

IMPLICATIONS OF PIAGET FOR THE DEVELOPMENT OF CURRICULUM:

Chair Person: Priscilla Wong, OTR, Assistant Professor, Department of Occupational Therapy, USC

Margaret E. Smart, Ph.D., Associate Professor, School of Education, USC

"Piagetian Theory and the Development of a Model Curriculum for Young Children"

Barry E. Breidenbaugh, Ph.D., Educational Psychologist, Oakland Schools, Michigan

"Study of the Effect of a Structured Curriculum in Piagetian Type: Operations on the Cognitive Coping of Elementary School Children"

Barbara Presseisen, Ed.D., Curriculum Consultant, Research for Better Schools, Inc., President, Jean Piaget Society, Philadelphia

"Individualizing the Social Studies: An Application of Piaget's Theory"

Avis C. Swart, Assistant Professor, Plattsburgh State University, Plattsburgh, New York, Kathleen Kennedy, Teacher, Plattsburgh State University, Plattsburgh, New York, Carol Vacher, Assistant Professor, Plattsburgh State University, Plattsburgh, New York

"A Response to Furth's Piaget for Teachers"

ARITHMETIC AND THE DEVELOPMENT OF LOGICAL ABILITIES:

Chair Person: Abraham Ariel, Ph.D., Assistant Professor of Special Education, California State University at Los Angeles

Phyllis Hallenbeck, Ph.D., Director of Psychology, Sagamore Hills Children's Psychiatric Hospital, Sagamore Hills, Ohio (paper to be read by Telford I. Moore, Ph.D., Riverside City Schools)

"Remediating Arithmetic via Teaching Logical Abilities"

J. Dan Knifong, Assistant Professor of Human Resources, West Virginia University

"Logical Abilities in Young Children: Two Styles of Approach"

DEVELOPMENT OF MORAL JUDGMENT IN CHILDREN:

Chair Person: Brother James Allen, Lutheran Deacon Association, Directing Brother, State Church in Denmark

John M. Reeves, Ph.D., Assistant Professor of Preventive and Community Dentistry, Loma Linda University

"Modification of Age Specifics of Piaget's Theory of Development of Intentionality in Moral Judgment in Children"

Linda Gunsberg, Clinical Psychologist, Child Development Center, Jewish Board of Guardians, New York, New York

"Conflict Training and the Development of Moral Judgment in Children"
Paper read by Kiomars Fiazi, Department of Psychology, Los Angeles City College, Doctoral student in Educational Psychology, USC.

PIAGET AND VYGOTSKY

Chair Person: Sarah Moskovitz, Ph.D., Assistant Professor, Department of Psychological Foundations, California State University at Northridge, Post Doctoral Fellow in Psychology and Education, UAP

Bryce F. Zender, Jr. Ph.D., College of General Studies, Western Michigan University

"Commentary on Dialogue: Piaget and Vygotsky"

Sarah Moskovitz, Ph.D.

"Do pre-schoolers who cannot Sort by Color, Form and Function Prefer the Help of Piaget or Vygotsky?"

COGNITIVE GROWTH AND LANGUAGE

Chair Person: Christine Harris, Ph.D., Director of Training in Communicative Disorders, UAP

Ernest L. Moerk, Ph.D., Assistant Professor of Psychology, California State University at Fresno
"Cognitive Development as Explored by Piaget and Its Impact on Language Development"

Robert A. Klein, Assistant Professor of Pediatrics, University of New Mexico School of Medicine
"Cognitive Growth in Young Children: Some Theoretical Implications Pertaining to Identity, Language and Memory"

Paper read by Barry Miller, Ph.D., Chairman, Psychology Department, Pacific Oaks College

Fredrick A. Williams, Graduate Student of Psychology, Wilkes College, Wilkes-Barre, Pennsylvania
"Corresponding Effect of Egocentrism on Concept and Social Development in Young Children"

PIAGET AND THE EARLY EDUCATION OF HANDICAPPED CHILDREN:

Chair Person: Rose Marie Swallow, Ed.D., Assistant Professor of Special Education, California State University at Los Angeles

Patricia Simmons, Ph.D., Assistant Professor of Special Education, California State University at Los Angeles
"The Role of Piaget in the Parent-Infant Program"

Rose Marie Swallow, Ed.D.
"Spatial Education for Blind Children"

Shirley Newman, Ellen Bubrick, Brian Burg, Deran Mooradian, Rick Morris, Graduate Students in Special Education, California State University at Los Angeles
"Classroom Activities for Spatial Education of Blind Children"

PIAGET AND THE DEVELOPMENT OF READING ABILITY

Chair Person: Marcia Maguire, Psychologist, Charter Oaks Unified School District, Doctoral student, USC

Patricia McGowan, Teresa Fabian, Graduate Students, California State University at Northridge
"Relation Between Piagetian Concept of Conservation and Reading Achievement in Second Grade Children"

Bickley F. Simpson, Ed.D., Lesley Schools for Children, Cambridge, Massachusetts (Read by Marcia Maguire)
"Multiple Classification, Class Inclusion and Reading Ability"

PIAGET AND PSYCHOMETRIC ASSESSMENT

Chair Person: Russell Orpet, Ph.D., Professor of Educational Psychology, California State University, Long Beach

C. Edward Meyers, Ph.D., Russell Orpet, Ph.D., Roland K. Yoshida, Doctoral Fellow, Department of Special Education, University of Southern California (Paper presented by Mr. Yoshida)
"A Psychometric Approach to Piaget: Some Methodological and Theoretical Implications"

Adelina Civretta, Teacher, Fullerton Elementary School District, California
"Gesell Developmental Age and Piaget's Concept of Conservation"

Jacob Joseph Horowitz, Ph.D., Assistant Professor of Psychology, West Los Angeles College
"A Comparison of Wechsler IQs and Piaget Levels in Children"

Mary Ann Pulaski, Ph.D.

Compared with other areas of human development very little attention has been given to the nature and function of children's make-believe play. Some writers such as Mark Twain and A. A. Milne, author of "Winnie the Pooh", have given us delightful descriptions of the fantasy play of children, but by and large most adults tend to tolerate, ignore, or actively criticize it. The 19th century educators, Froebel and Pestalozzi, were aware of the importance of imaginative play in early childhood, but their influence was counteracted by that of Montessori, who frowned upon fantasy as "a somewhat unfortunate pathological tendency of early childhood" (Hill, in Garrison, 1926, p.xiv). Her materials were designed to suppress fantasy and imaginative play. Children should not make believe, Montessori declared: "to encourage them along such lines was to encourage defects of character" (Gross & Gross, 1965). The fact that Montessori's theories and materials are enjoying such a revival today makes one wonder whether they may be contributing to a decrease in fantasy play.

Probably the most influential theory of play was that of Sigmund Freud (1962) who felt that the creative processes of adults grew out of their childhood fantasies. He hypothesized that thought originates when an infant is deprived of something he wants very badly, such as his mother's breast. When his need becomes so great that he cannot stand it, he "hallucinates" an image of the breast which helps to comfort him and make the delay endurable until she comes to nurse him. Thus for Freud, thought and imagery grew out of deprivation and a need for wishfulfillment. His followers have continued to see fantasy and make-believe play as an expression of unfulfilled needs, or an acting out of anxieties and conflicts. Practically every play therapist has a dollhouse and a family of dolls, and reams have been written about the traumatic family situations which have been acted out by children during make-believe play in the therapist's office. Even the learning theorists such as Sears and his associates have come to see make-believe play as an outlet for antecedent frustrations. This "catharsis" theory of play, which also includes the need to master anxiety-provoking situations by playing them out over and over again, has dominated our attitudes toward make-believe play for half a century.

But what Freud overlooked was the joy and delight that children show when they are playing their make-believe games. Anyone who has ever watched a group of children absorbed in playing house, or "cops and robbers", knows that they are having a perfectly wonderful time! This Piaget did not miss, and this is why he gave the name "ludic symbolism" to children's make-believe play. *Ludus* is Latin for play or jest – the root word in *ludicrous* – and the term *symbolism* refers to the *as if* quality of make-believe, wherein a stick is used *as if* it were a gun, or leaves and acorns are used *as if* they were plates and cups. In other words, the hallmark of make-believe play is the ability to use objects as symbols for other objects or people not immediately present, and to act out the fantasy with a sense of joy and delight.

It is because of its symbolic function that play is so important, according to Piaget, in the child's cognitive development. Play bridges the gap between concrete experience and abstract thought. In make-believe play the child is still dealing in a sensory-motor way with concrete objects, but the objects are symbols for something else of which the child is thinking. Sometimes the connection is obvious, but sometimes it is quite remote. A rag doll is an obvious substitute for a baby, but when Piaget's daughter, Jacqueline, (at 1 yr. 11 mos. or 1:11) slid a shell along the top of a box, Piaget had no idea what it represented until she said, "Cat on a wall."

There are two ways, according to Piaget, in which the child attempts to cope with the many new experiences of his pre-school years. One is imitation; by mimicking the words and actions of the adults around him, the child learns to speak and to behave as his family does. Imitation appears very early in infancy and appears to be an effort to accomodate to the environment. Babies will cry when they hear other babies cry or smile in response to smiling faces. Later on they play peek-a-boo or produce sounds that approximate their parents' words, such as "da-da" or "bye-bye." In imitation the child seems to be making a serious effort to master new activities by mimicking the people around him. To use Piaget's terms, accomodation takes precedence over assimilation in the effort to adapt to new experiences.

But when the baby begins to repeat his actions just for the fun of it, and to laugh and crow as he does it, he is discovering the joy of play. During the sensory-motor period most play is characterized by repeated motor patterns accompanied by smiles and laughter. Piaget has described how his son Laurent, who was learning to push aside his father's hand in order to reach a toy, was having such a good time pushing his father that he forgot all about the toy! His interest was transferred from the goal of the activity to the activity itself, and he was enjoying the functional pleasure of play for its own sake (Piaget, 1962, p. 92).

Near the end of the sensory-motor period simple motor games give way to make-believe games characterized by the emergence of ludic symbolism. Jacqueline at one year three months saw a fringed cloth whose edges reminded her of her pillow. She lay down and pretended to go to sleep, laughing all the time. Five months later she pretended to eat a piece of paper, saying "Very nice!" Lucienne, at

about the same age, pretended to drink out of a box, and then held it to the mouths of all who were present. In all these activities the objects used were symbolic of something else not actually present. Piaget felt that games such as these helped the child to express himself imaginatively and eventually to develop a rich and creative intellectual life.

Of course Piaget was aware that there are other types of play which he discussed in some detail, seeking to explain the evolution of play and why it disappears in later years. He concluded that there are three main categories of play: practice games, symbolic games and games with rules. Practice games appear first and are an outgrowth of the imitative activities of the sensory-motor period: pitching pebbles, stringing beads, jumping rope and so forth. Such games may lead to improved motor performance or they may develop into symbolic games, such as building a castle out of sand. As children grow older and become more socialized, the practice games may become games with rules, such as hopscotch or marbles. Piaget felt that games with rules are essentially social, and since they persist even among adults perhaps this is the explanation of what happens to children's play: it dies out in later years in favor of socialized games. There are also constructive games such as building or weaving but Piaget regarded these not really as games so much as a bridge between play and work, merging imperceptibly into the practical skills of adult life.

Most of Piaget's interest centered upon symbolic or make-believe games, which are both imitative and imaginative and which "imply representation of an absent object" (Piaget, 1962 p. 111). This kind of play is at its peak between the ages of two (the end of the sensory-motor period) and four. Piaget as usual carefully classified into types and subtypes all the developments he observed in children's play. Type I included the projection of the earliest symbolic schemata onto new objects. Jacqueline moved from pretending she was asleep to making her doll and her bear go to sleep. Lucienne pretended to telephone, and then made her doll telephone, and finally used all kinds of things, such as a leaf, instead of a real telephone receiver.

In the following months the children began to use their own bodies to represent other people or things. Piaget called this Type II behavior. Jacqueline at two years old moved her finger along the table and said "Finger walking – horse trotting." Lucienne played that she was the postman, or her godmother, or "Thérèse with her velvet hat." At four, she stood quite still beside Piaget one day imitating the sound of bells. "I asked her to stop," wrote Piaget, "but she went on. I then put my hand over her mouth. She pushed me away angrily, but still keeping very straight, and said: 'Don't – I'm a church' (the belfry)" (1962 p. 125). Here we see clearly how Lucienne was using her own straight little body to represent the steeple and reproducing the sound of the bells with her voice.

In Type III there appears the transposition of whole scenes, instead of isolated bits, and long, complicated episodes of play-acting sometimes sustained over periods of time. At around two and a half Jacqueline pretended to prepare a bath for Lucienne, using an empty box for the bath and a blade of grass as a thermometer. She plunged the thermometer into the bath, and finding it too hot, she waited a moment and tested it again. "That's all right, thank goodness!" she said, and then pretended to undress Lucienne, garment by garment, without actually touching her.

About a month later Jacqueline pretended to be walking a baby to sleep, talking to it as she held it in her arms. A week later, as she played the same game, she stopped talking when anyone came near. From a distance Piaget could hear her saying things like, "Now we're going for a walk." Already Jacqueline's make-believe play was becoming a secret inner experience.

At this stage of symbolic play, children often invent imaginary companions. At four, Jacqueline had a dwarf and later a negress named Marécage. Piaget feels that children create these characters "to provide a sympathetic audience or a mirror for the ego" (1962, p. 131). They become playmates, inseparable companions, and sometimes even take on the moral authority of the parents to make the children behave. Children may refer to them quite openly or whisper to them as secret companions. Piaget feels that just as Jacqueline stopped talking out loud and interiorized her make-believe play, so these imaginary companions may become interiorized as day-dreams.

What Piaget calls *compensatory* play is also included in his discussion of Type III. This involves doing in make-believe what is forbidden in reality. He describes Jacqueline at 2:4 going through the motions of pouring water with an empty cup after she had been forbidden to play in the real washtub. At 2:7 she wanted to carry Lucienne, who was then a newborn baby. When her mother told her she could not carry the baby yet, Jacqueline folded her arms and announced that she had the baby – there were two babies. Then she rocked and talked to the imaginary baby, and even said she *was* the baby when she was scolded for screaming with temper, thus excusing her behavior. By the time she was four, Jacqueline had a well-developed imagination, and whenever she was restricted in any way, she could make up a "compensatory" tale in which the direction of her desires was clear. When she was angry at her father she announced that Marécage (her imaginary friend) "has a horrid father. He calls her in when she's playing. Her mother chose badly." When she was told to take a nap, Jacqueline said, "Marécage never lies down in the afternoon; she plays all the time." Clearly, she was working out in her make-believe play what was forbidden in reality.

This of course is very close to the Freudian view of play in which emotion is acted out in gradual degrees, so that it

becomes bearable. Play therapy is frequently concerned with reliving experiences of hospitalization, death, or other trauma of childhood. In so doing, children gradually reduce their fearful feelings thus making the situations more tolerable. This is the usual explanation of why children enjoy horror movies on TV. They know the scene is not real, that they can turn it off at will, so they are able to cope with the horror and master their own fear in slow degrees. In the following observation Jacqueline shows how a child acts and learns to live with the unpleasant realities of life.

"At 3:11 J. was impressed by the sight of a dead duck which had been plucked and put on the kitchen table. The next day I found J. lying motionless on the sofa in my study, her arms pressed against her body and her legs bent: 'What are you doing, J? Have you a pain? Are you ill?' 'No, I'm the dead duck.'

At 4:6, I knocked against J's hands with a rake and made her cry. I said how sorry I was, and blamed my clumsiness. At first she didn't believe me, and went on being angry as though I had done it deliberately. Then she suddenly said, half appeased: 'You're Jacqueline and I'm daddy. There! (she hit my fingers). Now say: 'You've hurt me.' (I said it.) 'I'm sorry, darling. I didn't do it on purpose. You know how clumsy I am,' etc. In short, she merely reversed the parts and repeated my exact words' (1962, p. 134).

These make-believe forms of play, as Piaget has pointed out, represent "pure assimilation". The child is free to interpret and even distort reality as he pleases, without having to conform to the demands of the real world as in imitation. The young child at this age is still very egocentric in his thinking, and is also subjected to more parental demands than at any time in his life. Constantly he hears "No no," "Don't touch," "Stay out of the street," "Don't get dirty," "Time for bed." He must be toilet-trained, learn to talk correctly, and use proper table manners. Piaget does not say this, but it is my feeling that at this age the child's life is polarized around his efforts to adapt to reality and thus please his parents (imitative accomodation) and his efforts to escape from those demands and satisfy his own ego through his make-believe play (symbolic assimilation). As the accomodation to reality becomes easier, the polarity between these two processes decreases. Gradually they converge in increasingly well-adapted functioning, until the child's play becomes almost indistinguishable from his daily reality.

We see this during the second half of the preoperational period, when symbolic games begin to lose their importance. It is not that they decline so much as that they come closer and closer to reality as the child accomodates to a greater and greater extent to the world around him. Piaget notes that after the age of four, symbolic games become much more orderly, as opposed to the incoherence of earlier games. The child is improving in language skills, and also emerging from the egocentric world of his own needs into the world of reality. He notices how events follow each other in time and space, and his stories become much more precise and coherent.

Another characteristic of play at this age is that it reproduces an increasingly precise imitation of reality. There is "increasing attention to exact detail in the material constructions which accompany these games: houses, cots, tables, kitchens, drawings and models" (1962, p. 136). This is the time when little girls delight in dollhouses complete to the tiniest pots and pans, and boys like realistic forts and guns. Their play becomes increasingly a replica of reality, not only on the level of the setting and properties, but also on the level of what happens in their games. From about five and a half onward, Jacqueline constructed an entire village which she called Ventichon. She, and later Lucienne, spent hours acting out real-life scenes in the lives of its inhabitants – weddings, family visits, dinner parties, and so on. The little girls began to play "permanent parts as mothers of families with numerous children, grandparents, cousins, visitors etc., the husbands being rather in the background. 'Mrs. Odar' and 'Mrs. Anonzo,' etc. thus became the starting point of new cycles, analogous to those of the preceding stages, but much closer to reality, always true to life and with scenery and buildings which became more and more elaborate" (1962, p. 138).

A third characteristic that Piaget notes is that after the age of four or five symbolic play becomes increasingly social. *Collective symbolism* is his term for play in which children take different parts and act them out with an awareness of each other, as in the cases of Mrs. Odar and Mrs. Anonzo above. This is in contrast to the symbolic play of younger children, which tends to be carried on alone, even when the child is in the company of others. As in parallel play, in which the pre-school child plays beside another child without playing *with* him, so early symbolic play is usually carried on individually, using dolls or a much younger child who passively carries out his role, without really understanding or taking part in it. ("You can be the baby and sleep in the carriage," four-year-old girls will say to a much younger child.) But Piaget traces the way in which this sort of imaginary parallel play evolves into group play with each child taking a different role and reacting to the others involved. The following delightful observation shows clearly how Jacqueline at four was ready for a collective, socialized game, while Lucienne, who was only two, was not.

"At 4:7 J. did her utmost to stage a scene with a car ride, L., who was 2:2 was in process of constructing a bed, and said 'Brr' to show that she was taking part in the movement of the car, but did not stop her own game. What followed was for L. a confused medley of the two games, while J. perseveringly arranged the parts. J. came off victorious, and made L. the wife of a doll, 'You're the wife of this husband. Yes' , and herself another lady: (J.) 'We're two ladies in a car.' (L.) 'Are you in a car, madam?'

(J.) 'Yes, and I'm throwing your husband and your child through the window' (she threw the doll away). But L. went and got it and forgot the game" (1962, p. 139).

After the age of seven or eight there is a definite decline in symbolic play, according to Piaget. This age marks the emergence of concrete operations; it also coincides with increased interest in school, and in socialized activities and games with rules. The symbolic games lessen as socialization progresses until by eleven or twelve (period of formal operations) they disappear or are transformed into daydreams (internal) or dramatics (external).

Symbolic play seems to end with childhood; we have seen how the ludic symbols imitate reality even more closely. As the child accomodates better to the outer world, he has less occasion to assimilate reality to his personal inner needs, thereby distorting it. For the well adapted child, play is no longer very different from intellectual activity. Piaget traces this transition from symbolic games to spontaneous creative activity in the play of his son Laurent, who like his sisters created an imaginary village. At about seven, he began to make maps of the country where this village was and to imagine all sorts of people who lived there and the adventures they had. After the age of eight the imaginary characters disappeared, but the careful, detailed maps grew into cartographic models. During an illness that year Laurent worked out descriptions of the climate in different zones of his country, which he called Siwimbal. At nine his interest advanced to real maps of all parts of Europe. Finally, when he was about ten, Laurent's symbolic play appeared on another plane. His maps were quite correct and objective, but the boy now became fascinated with the study of history and reconstructed the costumes, furniture, and architecture of various periods. He dressed tiny toy animals in the costumes of the Middle Ages, the Renaissance, or the eighteenth century. He and a school friend went carefully through the literature on each period so that they could make their reproductions exactly. Here symbolic play began to merge with intellectual and artistic creativity. As Piaget says, "One needs to have seen a little monkey in a wig, a three-cornered hat, silk breeches and lace ruffles, in an eighteenth century setting made of cardboard, in order to understand the pleasure that two eleven-year-old boys can find in spending their leisure time in evoking the spirit of the past" (1962, p. 141). In this description we see clearly how the ludic symbol has developed into "an image whose purpose is no longer assimilation to the ego but adaptation to reality" (1962, p. 142). Laurent's activities no longer represent private fantasy but socialized study. The long period of childhood is at an end.

What happens then to fantasy, the lovely private world of make-believe, when childhood is left behind? We have said that some of it is "interiorized" in daydreams but Piaget feels much of it goes to enrich developing intellectual interests, such as Laurent's study of historical periods. "Creative imagination", he states at the end of his discussion, " - - - does not diminish with age but - - - is gradually reintegrated in intelligence, which is thereby correspondingly broadened" (1962, p. 289).

It has been almost thirty years since Piaget published his theories about children's play in French. They appeared in English in 1951 and have stimulated new interest in this subject. Just recently a number of new books on children's play and fantasy have appeared. Herron and Sutton-Smith have brought out a collection of papers called *Child's Play* (1971), which reviews all aspects of children's play from street games to sex differences. Eric Klinger of the University of Minnesota has written *The Structure and Functions of Fantasy* (1971) which examines the relationship between children's symbolic play, adolescent fantasies, and the dreams, both day dreams and night dreams, of adults. The most recent book called *The Child's World of Make-Believe: Experimental Studies of Imaginative Play* (1973) is by Jerome L. Singer of Yale University. Along with an interesting explanation of Singer's theoretical rationale, there are four chapters written by his doctoral students, describing their experimental studies in this area under his supervision. Since my dissertation was a part of this research, I should like to describe briefly the theoretical position of its authors.

Dr. Singer is a clinical psychologist who theorizes that the ability to make believe and to daydream is a cognitive skill which helps people to be more creative, more flexible in solving problems, and better able to postpone immediate gratification in favor of long-range goals. His interest in children's make-believe play has developed gradually out of his studies of daydreaming (1962) which he has been conducting for the past twenty years. In one such experiment he found that there was a significant difference in waiting ability between high fantasy and low fantasy children. He divided 40 little boys aged 6 to 9, into two groups on the basis of tests and interviews in which he asked questions about their favorite games, their parents' reading habits, what they played when alone, and whether they had ever had an imaginary companion. He ended up with 19 boys classified as "high fantasy" subjects, and 21 as "low fantasy", with no significant difference in IQs between the groups. He told the children he was looking for "space men of the future" who would have to be able to stand long period of solitary confinement. Then he asked the boys to sit or stand still quietly for 15 minutes, and measured the time that elapsed before they became restless. In another procedure, he asked the boys to stay still as long as they could, and signal when they had had enough. The results were very interesting. Although the mean waiting time was only about 6 minutes, the high-fantasy boys were able to wait significantly longer than the low-fantasy group in both situations. The ones who lasted longest were those who turned the situation into a fantasy game and made believe they were flying rockets or blasting off into space.

A consideration of the personality and family characteristics of these groups revealed interesting differences. The high-fantasy children tended to be the older children in their families, with close relationships with their parents, particularly their fathers, though there was no significant difference in how much their parents read to them. The boys had been asked to make up stories, and the high fantasy group's stories were rated as more creative and imaginative than those of the low-fantasy group. There were also clinical differences in the two groups which suggested a difference in life style. To quote Singer, the tendency toward fantasy behavior "seems to be a dimension of experience and exploration available to most children but one whose richness and frequency of employment grows from a set of optional conditions including parental interest and acceptance of imagination, availability of adults for identification, and opportunity or occasion for practice of fantasy by being alone" (1973, p. 73).

In view of the number of complaints in the schools today about hyperactive children with short attention spans who are highly distractable and cannot concentrate on school work, the implications of this study are very interesting. If the ability to make-believe and fantasize helps children to sit still and concentrate on their own thoughts, perhaps we should be actively encouraging this in schools today as a cognitive skill.

This imaginative experiment is only one of many which Singer has conducted or directed in an effort to study make-believe play in a systematic way with appropriate scientific controls. I will mention some others only briefly. My own study was an attempt to show that simple unstructured play materials would evoke much more imaginative make-believe play than would highly structured materials such as ready-made costumes or Barbie and GI Joe dolls with all their clothes and accessories complete. I used kindergarten, first and second grade children as subjects, divided into groups of equal intelligence. Half the children were judged to have high predispositions to fantasy (on the basis of tests and interviews similar to Singer's) and the other half were rated low in fantasy. I was very much surprised to find that the structure of the toys made very little difference; by the age of five the high-fantasy children were already playing in an imaginative, original way with all the toys, structured or not. The low-fantasy youngsters, on the other hand, fooled around manipulating all the toys, and their make-believe stories were more concrete and closely related to their daily lives. On a half a dozen measures such as the number of fantasy themes, the organization and variety of these themes, their distance from real life situations, the concentration of the subjects, and their flexibility in switching to new activities when interrupted — on all these measures the high-fantasy children scored significantly higher than the low-fantasy group. These results suggest that children's fantasy predisposition may be already pretty well formed by the age of five, and that children low in fantasy may be much less creative and flexible in their thinking, concentrate less well and stick to concrete ordinary themes when asked to make up a story. Again, the implication is that if children who have predisposition to fantasy can function so much more imaginatively and flexibly, and can organize and concentrate on their subjects so much better, perhaps we can find a way to foster and encourage these fantasy skills.

It begins to appear that the predisposition to fantasy is part of one's general life style from preschool years, and that it represents a dimension of human skill or competence available for the enhancement and enrichment of life. If the ability to engage in fantasy or make-believe play is such a useful and valuable skill, how can we help our children to attain it? Let me sketch for you very briefly two studies on the effects of modeling to increase fantasy and make-believe play. In the first, Joan Freyberg selected 80 disadvantaged kindergarten children in New York City whose parents had little education and were economically hard-pressed. She divided them into high and low-fantasy groups and a control group and then had all the children systematically observed during a free play period. Then she gave eight training sessions in small groups to all but the controls, during which she used pipe cleaner people, Playdoh, blocks and Tinker Toys to act out small plots and engage in make-believe adventures. She encouraged the children to adopt roles, act out stories and make their own sound effects. She used four main themes, but she encouraged each child to make up his own story. In the beginning she had to do most of the story-telling, but as the children caught on they took the initiative and the plots took all sorts of spontaneous, original and sometimes surprising turns.

At the end of a month, both experimental groups had improved significantly in the imaginativeness of their play as well as in the expression of positive emotions and the degree of concentration shown in their play. The control group which had had eight sessions manipulating jigsaw puzzles and Tinker Toys, showed no change. The high-fantasy group improved more than the low-fantasy group in imaginativeness and concentration but not in affect, indicating that both groups really enjoyed the training. Two months later the children were still playing with greater imaginativeness and improved verbal communication as well as more spontaneity, and increased attention span. Thus it was dramatically shown that by modeling and direct teaching Freyberg was able to effect marked changes in these children's functioning despite long-term lack in experiential background and cognitive development.

The second modeling study was conducted by Sybil Gottlieb with older elementary and junior high students. She showed them abstract sound and color films which she

either interpreted realistically or used as the basis for a fantasy story. Then she showed another film and asked the students to write their own interpretation. She found the junior high school youngsters much less susceptible to the modeling effects than the elementary children, who showed a significant difference in their responses to the fantasy and realistic interpretations. The junior high school students who had been classified as having a high predisposition to fantasy wrote original imaginative stories regardless of which kind of model they were exposed to, while the low-fantasy group were much more concrete, realistic and conventional in their responses. These results support the notion that the ability to make-believe and fantasize is part of one's personality organization; it is a skill that develops with age and becomes a part of one's cognitive lifestyle.

These last two studies show clearly the effectiveness of an adult model in helping children to develop make-believe stories and imaginative thought. Undoubtedly parents and teachers have been doing this more or less consciously for years, which is why even young children can be shown to have developed high levels of fantasy predisposition. There is other research described by Smilansky (1968) in Israel and El'Konin (1971) in Russia which implies that adult models are not only desirable but necessary to help children carry out make-believe play. Piaget believes that it develops by itself in the course of the child's intellectual development but he was working with his own bright, privileged children, and probably served as an unconscious model as well. If models are necessary or helpful, as the research seems to indicate, then it behooves us all to be aware of what kind of modeling we are doing, and what subtle signs of approval or disapproval we may be giving. Whether in teaching or nursing or therapy or just the daily business of childrearing, we are constantly either encouraging or discouraging children in the use of imaginative original ways of thinking and problem-solving.

To summarize, let me say once more that in the view of Piaget and other cognitive psychologists today, make-believe play is an intrinsic part of normal growth. "It represents an effort to organize the (child's) available experience and at the same time utilize motor and cognitive capacities to their fullest" (Singer, 1973, p. 23). We have seen that it is associated with verbal fluency, waiting ability, increased concentration, positive affect, flexibility, originality and imagination. Since it appears to be such a useful, creative skill, what can we do to encourage and foster it?

For one thing, children need privacy and time to themselves to think over and replay their experiences. It is difficult to make believe with the TV blasting or a mother constantly checking up on you. For another, they need an environment that is not too structured or well-ordered, so that they develop greater flexibility in using the materials at hand. I belong to a generation that used to play in the attic on rainy days, dressing up in old clothes and putting on all sorts of dramatic skits with appropriate sound effects. Children need a variety of interesting playthings which can be used in a number of different ways. I remember an old bathtub on legs which was used to represent anything from a pirate ship to the crater of a volcano.

Not only do children need time and opportunity and materials, they need a wealth of content for their make-believe play. This generally comes from being read to or having stories told to them by an appreciative adult. There have been many beloved storytellers throughout history from Aesop to Uncle Remus. It may be that television is providing much of the material for children's fantasy play in this generation. I personally think TV time should be limited and kept under strong parental supervision, but in homes where parents do not read to their children it may be filling a much-needed gap. Singer feels strongly that television has had great impact upon the cognitive and fantasy development of poor children. Educated parents have always passed on legends, myths, fairy tales and poems to their youngsters, but the children of working class people may not have been exposed to such a broad range of stimulation. "In this sense, then, television has tremendously widened the horizons of the poor and provided them with a great deal of material that can be used in the course of make-believe and indeed may even have stimulated greater tendencies toward make-believe play than might have been in evidence in the past" (Singer, 1973, p. 43). The same would apply to the culturally deprived children one sees these days even in families of comparative affluence.

Only time and research will tell us whether Singer is correct, but it certainly appears that children tend to play out in fantasy what they see on TV, particularly in an accepting environment. If parents and teachers enter into and encourage make-believe play instead of shaming or making fun of it, the child is much more likely to develop this skill. If not, the adult can help him, beginning even in infancy with make-believe games like "Patty-cake" or "This little piggy went to market." We have already discussed the importance of adults as models in make-believe games, charades, or role-playing. Richard deMille feels this is so important that he has written a book called "Put Your Mother on the Ceiling" (1967). It is written mainly for teachers, to help them develop their children's imagination through fantasy games. The teacher may start with having each child visualize his mother; then picture her in a red dress; then in the corner of the classroom and so on, until he has her floating up to the ceiling. This kind of teaching might be very effective with poor or culturally deprived children, and certainly could not hurt even imaginative youngsters from enriched backgrounds.

In closing, I would like to make a final plea that children be allowed to enjoy the magical world of childhood. In this

age of too many things and not enough time, let us not push and drag and harass our children to accomodate to a world that many of us find increasingly unsatisfying. Let us give them time and privacy and respect, as they play out their fantasies and dream their daydreams and try to bring imagination and understanding and maybe even a little romance to this tired old world. We could all use it.

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Commentaries Re Pulaski Paper

Dr. Gerald I. Lubin: It appears to be my fate to be a sort of devil's advocate. When I'm speaking to a group of psychiatrists and psychoanalytic theory is discussed, I am a staunch supporter of Piagetian theory. Here I must ask you to look more broadly. Piaget has helped us and continues to help us to understand cognitive development and this is extremely valuable, but particularly when it's considered in the perspective of other important developmental dimensions. I refer to Erikson's theories of psychosocial development, Anna and Sigmund Freud's theories of psychosexual development, and the theories of Sears and some of the other behavioral and learning theorists. There isn't time now for us to compare these theories, but they are comparable and they do provide other important contexts in observing the behavior of children. In addition to learning, for example, at different times the same action of an infant, such as bye-bye, can also represent social interaction, functional pleasure, expression during the anal periods of the modalities of holding on and letting go, experimentation through visual perception as Piaget describes with near and distant space, rhythmical motor actions, or reality testing including differentiation of self and object. These theories help us to keep in mind that there are multiple meanings and significance in behavior: object relations, mastery, exploration, reality testing and other ego functions. In summary, Dr. Pulaski has helped us to understand an extremely valuable point of view in which to understand play activity. This understanding will have the greatest impact if it's considered in a framework that allows for other empirical points of view to be used in working with and studying an individual child.

Dr. Yvonne Hansen: I would just like to make three points. First I wish to tell Dr. Pulaski how delighted I am with her paper because it emphasizes the time involved in the development of the child. Moreover, it stresses that time spent in symbolic play is essential to his development and has far-reaching implications not only for the child's ability to adapt, but also for the construction of his intellectual capacity and his creative possibilities. I know Piaget quite well, he has many times emphasized the necessity to give time for the child to grow and the important of allowing him to experiment with the world through various means by himself. Piaget has also emphasized giving time to children in another way; we adults, teachers or therapists often talk too much to children and listen too little to what they have to say. This might seem to be in contradiction with some of the studies Dr. Pulaski presented, for example, the studies of modeling. I think we have to distinguish here between two groups of children, children who have a normal, average environment and children who have a deprived environment.

Piaget through his theory of equilibration or a self-regulatory process of development shows us that the child does not need much teaching in the sense of input given him. The child needs to be in contact with a great deal of varied materials, but he is the organizer of that external input through the internal cognitive structures available to him. In other words, the organization and construction of mental structures constitutues a self-regulatory process. I think this is very important to understand and has wide applications, particularly in the field of education.

Secondly, I would like to put what Dr. Pulaski has told us about symbolic playing in the context of Piaget's developmental theory. Symbolic play is but one manifestation of the symbolic function which appears around the age of two. The symbolic stage differs greatly from the infancy period because the child becomes capable of having an internalized experience as opposed to the previous sensori-motor or behavioral experience. What is the nature of this internalized experience of the two year old child? It has many elements. The main characteristic seems that the child becomes capable of manipulating mental symbols, of using one element to represent an object, an event or an experience that is not immediately present. This object, event or experience could take place in the past, in the present, in the future or it could happen somewhere else in space. Symbolic function has several manifestations: differed imitation, mental imagery, language, dreams, symbolic play or action. When a person, an object or an event in its elementary form in the world becomes overt each of these symbols is connected to an object or to an event that is part of the sensori-motor and representional experience of the child not the real object. Let us take the example of the word "car". The word "car" evokes a certain kind of image and also a certain kind of experience that accompanies it and differs greatly from one child to the other. The only symbol that is common to all of us is the word itself as a means of communication. The point I want to make here is that the active experience of the child, is inherent in his mental symbols, in his symbolic play and in the significance that he gives to a word. A child of two years knows very little about the world and knows very little about a car. He has had a certain kind of experience with it, but it is a very different experience from the older child. The period between 2 - 4 years is the time when the child is able to construct and consolidate these mental symbols of which symbolic play is one manifestation. I would like to say here that the type of activities the child has in relation with the outside world is one very important factor for the formation of his intellectual activity, and the construction of future mental operations.

In brief, play activity and contact with various materials is an absolutely essential stage of development.

The third point I would like to make, is the implication of these concepts for our educational system or even for the way we raise our children. Activity is really the key word in the Piaget system. The child has to be able to move, to look, to act, to touch, in order to grow, and I therefore, with Piaget, question our system of education which emphasizes sitting in the classroom, using a minimum of active experiences and primarily rewarding the use of symbolic systems, such as reading and writing.

C. Edward Meyers' Comments:

We all tested out fantasy against reality as we grew up. I grew up with the help of the silent movies. Poor Mickey Mouse being chased by the cat, who was gaining, the gap closing. Mickey turns around and readjusts his tail, and it is now a propeller so that he zooms away out of danger. Then he comes back and bugs and bothers the cat, and the cat has to go hide somewhere from this magnificent mouse. We would enjoy the experience and relieve our feelings, then go out into the contrasting real world where we could not find such easy solutions to our difficulties. In our everyday play, we also slipped easily into fantasy and out of it again. My brother and I held off this huge army of bad guys, where the bushes in front of our house were our fort. We were nearly gone, but we got this bunch of thousands of good guys on our side. They got wiped out, so we were alone again, but holding our own. It was touch and go till Mother called us in for lunch. Incidentally, that was back in the silent movies where we went "Bang Bang" with our pretend guns. Nowadays the children make more realistic sounds.

The lesson which Dr. Pulaski has so competently provided us is best seen in a context of the history of psychology in America. That history, as the late, great psychologists' psychologist, E. G. Boring, tells us, features the excess preoccupation of American psychologists with formalistic science-by-the-book first and psychology second. Prof. Boring wrote that psychologists were so self-conscious about being scientific that method purism got in the way of scientific advance; they would not ask the right questions or address themselves to the most interesting phenomena.

Such was illustrated in the treatment of imitation and cognate phenomena by psychologists on account of of E. L. Thorndike, the first large scale investigator of children's learning in America. He said imitation provided nothing of significance to help explain learning and development. It was thus decades before the excellent work of Bandura and many others opened up for us the whole domain of what today is called observation learning and modeling, a movement which bids fair to provoke a revolution in some aspects of child rearing and formal education.

Why this prohibition, this dislike for the study of imitation? Why did fantasy take so long to come under objective scrutiny by anybody but Freud-influenced clinicians or Piaget? Nobody can make a simple explanation, but it is possible that Thorndike, as unabashed a connectionist-behaviorist as Watson or any other, would not trust any psychological endeavor or inference which would not consist of precisely defined stimulus conditions and precisely measured or counted responses, forbidding inferences about recondite internal organization. Observation learning or modeling and fantasy presuppose a somewhat internally governed control of behavior and an internally organized self-development, in addition to the stimuli under the experimenter's control. Observation learning, for example, is capable of causing a child to perform in ways that stimuli could not lead him to, or to learn *not* to perform observed behavior which is punished. Such learning is even difficult to explain in exclusive terms of S's and R's and their connections, and requires inferences about internal organization.

Ludic symbolism also exhibits a field of fascinating activity and development defying explanations in simplistic terms. It would be thought unscientific, for it requires admitting that people daydream and engage in fantasied solutions, vicarious trying out, thus internally governing the emission of responses by other than experimenter controlled stimuli. Yet the everyday reality of make-believe in children's life, so richly and abundantly described by Piaget and our speaker today, is something any of us as students of children's development might have demonstrated had we thought it might be acceptably scientific. Our speaker has shown once again, and with some dramatic force, that life does not consist of the cognitive separated from the affective, the logical from the fantasied. Piaget has insisted on their continuity, and upon their interplay for normal development.

All this leads to some questions for us who are in school work. How much longer will we pretend that the three R's constitute the major thrust of schooling? When will we operationally and meaningfully admit that imagination and fantasy are necessary, at least inevitable, in the normal childhood experience?

A moment's reflection indicates that we have already acknowledged fantasy's utility, though we may not recognize it under other titles. If we encourage "creativity" because that is a good and acceptable word, we have for all practical purposes encouraged make-believe. On this, the campus of J. P. Guilford, we should speak of "divergent production abilities", so critical for creativity. There is indeed no formal difference between make-believe and the hypothetical-deductive exploration of the theoretical physicist. Also, in our use of psychodrama and sociodrama, we are permitted to go off into fantasied solutions, to unreal levels, thereby to try out different solutions without paying the price for their physical trying out.

My point is that if we admit the reality of Ludic phenomena, and already have utilized them though not always willingly, we might as well carry on the work of systematic exploration of ways to exploit them in our programs, rather than just tolerate them. In any case, it would be fun.

Mrs. Priscilla Wong: One question I had for Dr. Pulaski was that we spoke in terms of the need for modeling and for providing the child with time and privacy for his organization. What about providing the child with an audience to encourage imagination? I realize that very soon the youngster begins to internalize some of his fantasy material, and it is good that he has his own world where his rules apply. Sometimes, he shares some of his world with certain of his good playmates. In our experience in working with children who are hospitalized and suffer from environmental deprivation, we find it very helpful for the youngster to share his imaginary world. Imitation and role development could be enhanced. Through our feedback the child could see for himself what the world is all about and to test his powers in that world. This will highlight the need for a differential approach in terms of the ratio of modeling adults to the number of children. Instead of 1 to fifteen, perhaps 1 to 6 or 7 may be more realistic for younger age groups.

I recall, particularly well, working with one youngster who was quite bright and verbal, but had had very unfortunate experiences having been in casts for months and being hospitalized for prolonged periods. During short intervals when he was home, the full body plaster cast was so heavy that his parents had difficulty moving him about. I asked him what he would like to do. What he wanted to do was to go *out*. Any place in particular? He did not know. I go *out*, his brother goes *out* — but to my little patient, *out* is just *out there*. He had no experience as to what being "OUT" meant. He did not know the outdoors, trees, sky, grass, butterflies or different buildings. Imagine his difficulty with spatial concept and temporal perspective.

Another question pertains to our interest in cultural differences. In Japan, toys are very realistic. Would that not hinder imagination? Occupational Therapists assist in analyzing toys and games for children.

Generally, non-specific toys lend themselves to more varied applications. Simpler toys have more play potential as they challenge both motor and cognitive capacities.

Lastly, I would like to suggest several ways in which Occupational Therapy can use Piaget's Theory. The developmental sequence outlined by Piaget reinforces those from other theorists: Gesell, Freud, Ericson and Sears. Stimulation for growth and integrative processes take time and much repetition. Most important of all, we cannot sufficiently emphasize the need to expose the developing child (both well and not well) to a wealth of material for optimal growth and adaptation.

Can the School be a Clinic? Should It?

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A man is relieved and gay when he has put his heart into his work and done his best; but what he has said or done otherwise shall give him no peace. It is a deliverance which does not deliver. In the attempt his genius deserts him; no muse befriends; no invention, no hope . . . . .

Whoso would be a man, must be a nonconformist. He who would gather immortal palms must not be hindered by the name of goodness, but at last sacred but the integrity of our own mind. Absolve you to yourself, and you shall have the suffrage of the world. I remember an answer which when quite young I was prompted to make to a valued adviser who was wont to importune me with the dear old doctrines of the church. On my saying, what have I to do with the sacredness of traditions, if I live wholly from within? My friend suggested, - "But these impulses may be from below, not from above." I replied, "They do not seem to me to be such; but if I am the devil's child, I will live then from the devil." No law can be sacred to me but that of my nature. Good and bad are but names very readily transferable to that or this; the only right is what is after my constitution; the only wrong what is against it. A man is to carry himself in the presence of all opposition as if every thing were titular and ephemeral but he. I am ashamed to think how easily we capitulate to badges and names, to large societies and dead institutions. Every decent and well-spoken individual affects and sways me more than is right. I ought to go upright and vital, and speak the rude truth in all ways . . . .

What I must do is all that concerns me, not what the people think. This rule, equally arduous in actual and in intellectual life, may serve for the whole distinction between greatness and meanness. It is the harder because you will always find those who think they know what is your duty better than you know it. It is easy in the world to live after the world's opinion; it is easy in solitude to live after your own; but the great man is he who in the midst of the crowd keeps with perfect sweetness the independence of solitude . . . .

"Self-Reliance," 1841, Ralph Waldo Emerson.

The significance of the above quote from Emerson cannot be over emphasized when one considers the concept of the Educational Clinic. The search for the realization of full genetic potential; the expediencies found in the systems approach; and our technocratic flirtations with standardization could lead us to an acceptance of the educational clinic as a procrustean bed for those individuals who do not fit the system (in Greek mythology, Procrustes was a giant of Attica who seized travelers and tied them to an iron bedstead, after which he either cut off their legs or stretched his victims till they fitted it).

The usual conceptualization of the educational clinic neither warns of the dangers inherent in such a concept, nor does it fully explore the full potential of such a scheme. The more typical approach seems more a reflection of the social state of educators over the years as opposed to a lucid expansion of the state of the social and technological arts of that period. The limited visionaries do not visualize the educational clinic as much more than a diagnostic center to be utilized by those who do not adjust well to the present system.

I have been captivated by the stimulating possibilities for all segments (input-output) of the educational use of the concepts rattling about with the educational clinic. Herein, then, I am attempting to explore some of my thoughts as to a direction for focus of our educational resources (horsepower).

1. A Reference

The point of departure should be a definition of a system of reference. Structuralism appears to offer an excellent model for dealing with the problems of our interacting societal matrix. I agree with Piaget in his definition of structure as a "system of transformations," which constitutes three basic characteristics: wholeness, transformation and self-regulation. These connote a closed system and a principle of equilibrium or a version of developmental homeostasis based on cybernetic and logico-mathematical principles. Structure for Piaget is equivalent to system in the U.S. To adopt a structuralist approach, one must add to Piaget's bioenergetic-mechanistic models an element of communication-information feedback which allows for "noise" (variation) and the possibility of positive-feedback leading to exponential growth and or evolution of the system.

As the agent of transformation our concept of the educational clinic is too limited. It must also encompass the role of self-regulation for the system. As Emerson stated so clearly

above, we cannot judge the "goodness" of an act if our point of reference is constantly changing. Therefore our educational clinic must allow for the evolution of the system and variation within the system. Artists are perhaps the most welcome variation (noise) for they not only enrich society, but also provide an element of feed-back.

2. *Some Preliminaries*

How then should we define an educational clinic? Contextually, the nature of such a clinic would have to involve feedback. This clearly suggests a research function for the clinic. Research today must be viewed in the context of the current "Information-explosion." Therefore, some system of centralization would seem appropriate to deal with the information to be digested. At the state level, the great universities would probably serve such a function more than adequately. Access to information related to weaknesses in the system would be provided to those charged with the administrative responsibility for the evolution of the system by the university. The university is herein envisaged as the principal organ for the collection of information.

If the university is to be the principal organ for the collection of information, then, the educational clinic may be viewed as one of many "receptor sites" providing raw data. But, as the hand is capable of providing information related to the temperature and feel of an object, it is also capable of manipulating an object. The educational clinic has such a dual nature. It provides a great deal of information and yet serves primarily a manipulatory function. The danger of the educational clinic is this manipulatory function.

After the determination of some type of dysfunction, a student would be brought in contact with the educational clinic, which would strive to effect his adjustment, modify his behavior, hasten his socialization, and, or change his emotional priorities and values. Some or all of the above manipulations are involved in the remotivation processes we use to deal with students who manifest educational or emotional dysfunctions. As our technical expertise in behavior modification improves, the "Orwellian" consequences for society seem to grow exponentially. Herbert Marcuse, although rather polarized along the continuum of thought related to social change, clearly understands that changes in values are effected from "without" the system, but, the fundamental grounding for the new values must come from "within" the system. One can only doubt that our society with ephemeral values (e.g. our changing attitudes towards sexuality) is capable of determining those transient values which will provide us with a frame of reference adequate to judge the merits of a particular regimen of behaviors or the transcendental nature of art. A Ralph Waldo Emerson would be a prime candidate for an educational clinic. His philosophy asserted the primacy of the spiritual and superindividual as opposed to the material and empirical. The rationality of the educational clinic must be tempered with a sensibility so as to provide for interpersonal differences of interacting with society.

Those who determine the degree of manipulation to be administered by an educational clinic must be cognizant of the individual's need for emancipation. It would seem that a child's ability to assimilate and accommodate are related to his degree of social interaction. We cannot however determine universal modes of interaction which will meet the needs of all individuals. For, Piaget has suggested, the child is the most important contributor to his mental development and education. Piaget recognizes the role of social life as it affects intelligence. He has stated,

> The human being is immersed right from birth in a social environment which affects him just as his physical environment . . . Society, even more, in a sense, than the physical environment, changes the very structure of the individual, because it not only compels him to recognize facts, but also provides him with a ready-made system of signs, which modify his thoughts; it presents him with new values and it imposes on him an infinite series of obligations. It is therefore quite evident that social life affects intelligence.

One role of the educational clinic would be to produce those social conditions which maximize intelligence. This must be done in a way which is sensitive to the needs of the artists, the gifted and the disenfranchised. Dehumanization is perhaps the greatest danger of the educational clinic. Marcuse feels that nuclear war is not the greatest threat to man, but rather the prospect of total "Moronization, dehumanization and manipulation of man." These are legitimate concerns. Marcuse offers rationality and sensibility as prior conditions for the fundamental changes he feels our society needs. We may use these twin guideposts as we laveer through the winds of social change. In educational terms, we may consider the relationship of rationality with cognition and sensibility with affect.

We must decide if we want the educational clinic to deal with the domain of affect as well as cognition. I feel the answer is clearly yes. In time we may find that many skills are best taught through computer assisted instruction (CAI). The role of the teacher would shift even further to that of bringing affect to education under such circumstances. The educational clinic must balance a child's inability to amass a body of information with his ability to utilize his knowledge, in establishing criteria for involvement.

Having looked at some of the dangers of an educational clinic, we may now examine the nature of such a clinic through a functional definition: An educational clinic should be an institution, which having made a diagnosis of the nature of a child's problem, offers a regimen of procedures designed to maximize a child's changes of success in

the system. The phrase " . . . success in the system" suggests a value judgment. The dangers inherent in this value judgment were explored above.

3. Potential Processes

The determination of criteria for involvement necessitates a dual nature for the clinic: Diagnostic and Rehabilitative. The diagnostic component is extremely important. Many children manifest aberrant or anomolous behavior which may have an etiology which is completely medical (e.g. malnutrition, hypoglycemia, and other disorders which affect behavior secondarily). Therefore, it would seem that a complete medical examination would be a part of the diagnostic evaluation.

Psychological and intellectual tests would provide needed information. Therefore the services of a psychologist would be necessary on the evaluative team. The psychologist could also provide individual achievement tests to augment that information provided by the student's teacher and dossier.

At this point, the evaluative team would determine if the involvement of the clinic is appropriate or if referral to a social agency or private professional help is more appropriate.

Unlike the shared services concept of a B.O.C.E.S. (Board of Cooperative Educational Services) as found in New York State, the clinic should not be primarily diagnostic in nature. Rather, the rehabilitative aspect should be emphasized.

The university must help in the determination of criteria. Research into the nature of the genetic potential of individuals has been the domain of the university. Such information must be available at the clinic level. Piaget's work on developmental stages and the consequences such stages have for genetic potential at any given age are too often neglected in the diagnostic process. Vinh Bang, a Vietnamese psychologist and Monique Laurendeau of the University of Montreal are currently attempting to apply Piaget's research to the development of a new I.Q. test. The consequences of such a new test on the diagnostic process may be greater than anticipated, but are clearly related to the establishment of criteria for clinic involvement. Batteries of such tests may be necessary.

Neurological tests have evolved dramatically during the past decade. The Reitan Battery is perhaps the most promising, but no significant effort has been made to adopt a battery of neurological tests for the diagnosis of school children. The incorporation of such a Battery and persons capable of administering it should be included in the establishment of an evaluative team.

We are then left with an evaluative team of specialists: Medical; Psychological, Neurological, Sociological; and so on, which is charged with the responsibility of diagnosing the nature and extent of the dysfunction and then referring the case to the proper agency or suggesting and developing a rehabilitative regimen designed to deal with the problem at the clinic. This function may be on an "out-patient" basis or residential.

How might this model be improved with respect to the problems of the urban child? Any model which includes a treatment or rehabilitative role is improved if the determination of the dysfunction is made earlier. How might this be accomplished for the present model?

4. A Bit More Speculative

Some present concepts of an educational clinic would be vastly improved if given another educational context. Let us suppose that group intelligence tests were available which were truly culture-free and were adjusted for the findings of Piaget and others. A more difficult assumption would be related to achievement. Let us suppose that educators, researchers and epistemologists agreed on desired achievement levels for the various intellectual levels. For the sake of simplicity, we might consider this the matching of achievement levels in various subject levels with mental ages. Now let us suppose that achievement tests were developed that adequately measured these parameters.

If the group intelligence tests were administered at the beginning of each educational block (possibly yearly), we would have a very good indication of the distribution of a class or a particular group of students. If accurate group achievement tests were administered to this population of students at the beginning and end of a block of education (yearly), we would have two distributions of achievement which would reflect the efficacy of our system of education and the ability of the teacher, or the efficacy of the C.A.I. element.

In a simplistic view, we might establish critical levels of separation for potential (intelligence or mental age) and achievement. With such a system, grade levels would be meaningless. Hopefully, research would provide us with the tools for accurately determining potential/mental age (intelligence). We would then examine the achievement level and assess the difference between the two. A critical factor of acceptability might arbitrarily be set at 80%. By this I mean to suggest that the relationship between potential and achievement is of critical importance. A critical factor of acceptability of 80% means that if a student's achievement level is 80% as great as his potential level for a particular area, we would be satisfied with this student's achievement. If this level dropped below 80% or a factor of 0.80 the student's level of achievement would be considered unsatisfactory. The function of the teacher would be to attempt to motivate all students to a level approaching 1.0. Clearly, if the critical factor exceeded 1.0 the level of achievement would be greater than the potential level; a condition which in theory could not exist. The significance of such a ratio would be that the student's intelligence test score is not valid or the achievement test score is invalid or both are incorrect.

The entire system could then be computerized with obvious advantages. By standard normal distributions, we expect that 5% of the population has an I.Q. of 75 or less. In a normal classroom situation, these students are considered to be chronic failures. But we may find that heterogeneous grouping maintains a critical factor of 0.80 or better as well or better than homogeneous groupings of mentally handicapped students. We could feed the results of our group testing into computers and begin to ask questions like: How many students with a critical factor of 0.85 in reading have a critical factor in excess of 0.95 in quantitative skills? Given a class with a mean critical factor in math skills of 0.87, what changes in this mean are produced by teacher "A" after 10 months of exposure to this class? We would, in short, have an approach to an objective method for the evaluation of teachers and our teaching methods and system.

The cause of individualized instruction would be approached in that the teacher's role would be that of increasing the critical factor of each student. Computers could tell us very early in a student's career if he were functioning at an acceptable level for his potential. We could ask a computer for the names of all students between the ages of 60 to 69 months who are functioning below a critical factor of 0.80. From my experiences in evaluating tests of young students, far fewer students would be classified "failures" at an early age than is currently the case, were such a system adopted.

The educational clinic would be involved in those cases where the CF (critical factor) dropped below 0.80 for example. Referral and screening would then be possible at a very early age, before potential behavioral anomalies develop from lack of success, frustration, etc. The number of emotional problems manifested by a student population might be significantly reduced.

In order not to pigeon-hole a student, critical factors for standard deviations in successive intelligence tests would have to be established so that if the intelligence of a student varies by too great a deviation, an individual test might be scheduled to confirm the score.

The teacher's establishment of acceptable criteria would be superfluous. The teacher would use tests during the year for her own feed-back in her attempt to elevate the CF for any particular student. Success in the classroom would receive a different definition. The assessment of cognitive advancement would no longer be in the teacher's domain. The teacher as well as the student would be under the assessment of such an approach.

Research into those factors which might be applied to large populations to change mean intelligence levels as well as mean achievement levels would be greatly facilitated. In other words, from a structuralist's point of view, we must recognize that research is a function of a self-regulatory system. Further, research into the efficacy of the information system is facilitated when data is collated and systematized. The final result is that self-regulation would be served by systematizing data as in the method suggested above. The form which this self-regulation takes is clearly related to the initial goals of the society with respect to education.

In "Beyond Freedom and Dignity" B. F. Skinner has suggested that our society can no longer accept the concept of complete freedom. He feels that individuals must be controlled and that "good behavior" should be conditioned into our population. Although this is an extreme view, one can easily visualize how simply an educational clinic with access to vast amounts of data could be prostituted to serve such ends.

On the other hand, an educational clinic might be intimately involved in the determination of "high-risk" individuals and their subsequent treatment. Sarnoff Mednick has, for the past nine years conducted a study in Denmark in which he is attempting to identify individuals with a "high-risk" of emotional breakdown. Mednick has identified factors which may account for as much as a four-fold increase in the probability of an individual experiencing an emotional breakdown before the age of thirty-five. Mednick has not resolved the nature-nurture controversy; but, he has added support to the concept that a genetic predisposition may demonstrate penetrance when given a proper environment. An application of a similar approach to learning difficulties might be fruitful in identifying other types of "high-risk" individuals. The educational clinic would seem ideally suited to such a study.

The Teaching and Understanding of Formal Operations

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What are Formal Operations?

A. The Problem

As I read book after book by Jean Piaget and about Piaget, I was constantly struck by the lack of definite and hence treatment of the Formal Operations Stage of intellectual development.

Some authors do not even describe, minimally, formal thought; others give cursory and inaccurate treatment to this most important of all of Piaget's formulations. Piaget, himself, is rather vague, at best, but usually inarticulate in his descriptions of formal logic. Even in his clearest treatment (genetic epistemology), he leaves to the reader to infer definite formal models and structures for himself.

In testing 600 children and adults in Malawi (Central Africa), 80 in Mexico, 1200 in Uganda (East Africa), and several hundred in California, I have found very little (in some populations none) evidence of formal thought being expressed. Extensions of concrete processes as abstract generalizations, several variable manipulations, derivation of isolated, speculative statements to be tried out at a future time are commonly seen in modernized, educated peoples (characteristics of Piaget's Stage IIIA). But the formal operations process of hypothetico-deductive theory building and testing (Stage IIIB), that process of *validly* examining, explaining and making predictions about seen and unseen phenomena, is rarely developed.

B. Formal Operations

The following model is an abstract picture of the logic of theory building. This picture exhibits how thoughts and processes can be validly confirmed so that subsequent developments can be based on firm and substantiated antecedents.

Quite possibly in all new thought we retreat into a pre-operational analysis of the individual variables in a situation (we ask "What?"). Next we analyze concretely the relationships between and amongst variables (we ask "How?"). We may come to logical conclusions and formulate generalizations as to what we have found. But at this point there is no basis for a valid analysis or a predictive structure. There is really only estimation and extrapolation – one stage above guess work.

For formal thought to be utilized, a special set of analytical processes goes on, taking the generalizations and by a unique calculus, transforms them into the sets of definitions, assumptions and propositions that are to be tested (as hypotheses) in a new field of experimentation, newer than has been previously used (we ask "Why?"). The results of this testing are fed back into the body of the theory to reorganize, re-adjust, re-orient, and increase its powers of explanation and prediction. Use of this *growing* structure as well as its logical principles is the formal operations process (akin to the mental adjustments involved in equilibration – assimilation and accomodation).

Theory Building

inductive	1. Interaction with materials and ideas – analysis of the variables in the situation (classification)
	2. Logically and empirically derived principles – generalizations (relational logic, combinational analysis)
process	3. Transformation of principles into the abstract body of the theory – definitions, assumptions, propositions (propositional logic, multivariable analysis, operations on operations)
	4. Derive hypotheses to be tested
deductive	5. Set guidelines for testing (scope conditions)
	6. Test hypotheses (probabilistic notions, permutative systems)
process	7. Refer results of testing to body of theory in order that modifications in the assumptions and propositions can be made
	8. Re-derive hypotheses and re-test

Formal operations, then, is the growing process of formulating hypothetico-deductive models and validly testing hypotheses contained in those models for attaining predictive validity in experimental findings.

Formal operations is not merely abstraction (abstraction occurs in all stages of intellectual development but is utilized differently), it is not isolated speculative statements or generalizations (sometimes but wrongly called hypotheses), it is not propositional logic or probabilistic thinking, it is not multivariable analysis, it is not information gathering. Formal operations is a total process embodying all of the above (and more) in a dynamic, model-building system of logical analysis.

Materials in formal operations are used as objects for analysis (as they are in pre and concrete operation) but also as objects of confirmation.

How can Formal Operations be Identified (tested for)?

A. I have modified some tests by Piaget and other researchers and developed several of my own that have these qualities:

1. They are suitable for indexing pre-operational, concrete operational and formal operational thought. They do not merely test one level of intellectual development.

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2. They have been developed by logically referring to Piagetian theory and then trying them out with individuals. In other words, they have been validated through a formal operations process.

B. Some possible tests of formal thought

1. Paper Discs (black-white, red-green, blue-yellow, orange-brown). Four, two-inch diameter discs having different colors on each of two sides are shown to subject. The subject is asked to identify the objects. He is then given one. He is asked, "How many ways can you show me the colors on this disc, only one color at a time?" After answering he is given two discs and asked " . . . two different colors at a time." then " . . . then three different colors at a time."

Finally, all discs are taken by the examiner and the subject is asked for the number of ways if he had four discs (the discs are kept by the examiner). The subject is then asked for the reasons he had for his answers.

The examiner is looking not for the "correct answer" but for the logical processes used. The formal thinker realizes there is a set of propositional rules that can be used to explain the relationships among discs. He uses the discs both to illicit this rule structure from his inteilectual models as well as to confirm it.

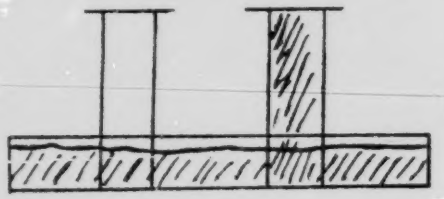
2. Batteries and Bulbs

Similarly to the disc problem, the subject is given a battery ("d" cell), a bulb and a piece of insulated wire with the ends bared. He is asked "How many ways can you light this bulb using this battery and wire?"

There are eight ways if each element is analyzed for its two "points" of contact. A rule of combination becomes 2^n. The same analysis is looked for as in 1. above: reason for results, how materials are used, etc.

3. Parallel Cylinders

Two one-inch diameter plastic cylinders are sealed at one end. One cylinder is filled with water, the other left empty; both are turned over into a tray of water. A thin, flexible, plastic tube and a large tin can complete the apparatus.



These questions are asked of the subject:

a. What are these materials?
b. Can you fill the empty cylinder?
c. Can you empty the full cylinder? (The subject may try out his method.)
d. What reasons do you have for what you have found?

These conditions (restrictions) are posed:

a. You can only use these pieces of apparatus.
b. You can lift the cylinders, but not out of the water.

Again the "right" answer is not as important as the process whereby the answer was determined. However, a concrete operational person may think of syphoning (moving water) while the formal thinker sees the necessity of moving air.

The formal thinker has a plan and uses the materials to confirm the plan. This test is more sensitive to other aspects of formal thought: especially the differences found between those who know beforehand and those who learn from the materials. Thinkers at an early formal level can formulate logic that doesn't meet the criteria of the problem. Only fully developed formal operators can predict correctly, carry out the prediction and explain the relationships in the problem.

4. Three Balls

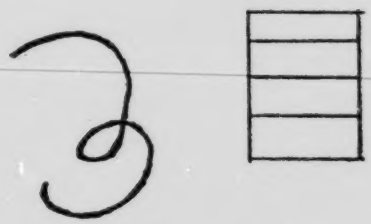
Three balls of approximately the same size and color (a golf ball, ping pong ball and plastic practice golf ball) are presented to the subject.

The subject is asked these questions:

a. What can you tell me about these three balls?
b. What would you have to know about these balls to know how high they would bounce?

Given the conditions that the subject can do anything he wants with the balls except drop them, ask:

c. Which ball do you think will bounce highest if they are dropped from the same height, at the same time?
d. What reasons do you have for your answer?
e. How would you test out your answer?



The balls can be dropped.

1. What reasons do you have for what you have found?

As before, the "correct" answer is not as important as the process of finding out.

First, does the subject pick up the most important variables in the problem for determining bouncing?

Second, does he manipulate the objects (how? when?)?

Third, can he set up a controlled experiment to test his ideas?

Fourth, what does he do with the results he has found?

These tests and others can be used to diagnose developmental learning, can be utilized for the development of curricula for encouraging the learning of formal thought and for the training of teachers in the use and facilitation of formal operations in themselves and other concrete thinkers.

How Can Formal Operations be Taught?

The individual that is to be introduced to formal operations must be facile with concrete operations: able and experienced in manipulating materials; capable of formulating generalizations; conserves number as well as area, shape, substances and volume; classifies according to multi-attributes, identifies variables; identifies relationships and manipulates them in novel ways; exhibits reversability.

An environment that encourages formal thought must now be provided:

1. A facilitator who himself is formally operational. He is a learner as well as a teacher. He allows many divergent responses, keeping those which meet the criteria set up. He accepts each person even though that person's findings may not "fit" or "work" in this situation.

2. Surroundings are rich in materials and ideas that encourage manipulation (firsthand), interaction and interchange.

3. The learning atmosphere allows for risk taking and creativity.

4. Constructive intervention takes place between learner and environment and amongst learners in a sensitive manner.

5. Criteria for acceptable results are set up by all learners in the situation.

6. "Messing around" is encouraged so that learners can "feel" the problem as well as "think" it.

7. Learner is actively involved in coming to conclusions and testing conclusions in new situations. His activity is reinforced "neutrally" by the teacher.

8. The type of materials present are chosen because they encourage and suggest formal thought, not stand in the way of it. Learning is tailored for the individual.

9. Evaluation tools are available to measure formal thought so that feedback is immediate and personal as well as shared.

10. The learner is placed in a situation of mild conflict and controversy with the materials and the ideas of his colleagues.

11. The training is from simple to complex, from concrete to abstract.

12. Environment allows for curiosity to be met with open discussion, mutual criticism, or support. Final arbitration is by replication with materials.

In summary, the formal operations is a difficult system to understand, but it can be successfully evaluated and taught.

My studies have shown that teaching formal thought to less technologically developed peoples, high school "failures" as well as graduate students is possible, and, in many cases quite easy. What implications do these findings have for widespread dissemination? Does it matter if formal thought is developed or not?

Let me take the second question first. High level technological development of our environment and emotional development of our persons requires formal thought just for survival. Whether in the laboratory, in industry, the university or hospital, formal thought is necessary for the creative production of the ideas and materials we need for taking "the next step." Formal thought is also important for every person who is a decision maker (and we all are). If most decisions can have valid responses, the predictability (hence certainty) of outcomes will be greater. Intellectual (and emotional) growth develops.

Formal thought can be taught. Groundwork can be laid in primary school through "free" use of materials. Concrete thought can be encouraged in the late elementary schools by confident teachers who will allow for generalizations to be made by each individual; shunning the "one right answer" approach.

The transition to formal thought (although much greater and more difficult than the transition to concrete thought) then becomes possible by using the criteria outlined above.

Finally, I have developed several new tests of formal thought that not only allow a spectrum of these operations to be viewed, but also show concrete and pre-operational responses to the same materials.

It is by this continued development that we will hopefully increase the significant contribution our schools can provide for our children who will not only live in the 70s, but in the next century.

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An Interpretation of Inhelder and Piaget

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Since the publication of Inhelder and Piaget's 1958 book, a number of investigators have asked subjects to solve problems that involve *"formal thinking."* There has been one rather consistent finding. *Not all adults demonstrate formal thinking.* In fact, after reviewing the experimental literature (including work by Kimball who is presenting at this session), Ross concludes that there may, throughout history, even have been "many societies" whose members "never manifested combinatorial and propositional logic or other characteristics of formal thinking."

Wason and Hughes (summarized in Wason, 1969) have even developed a task that appears to involve formal thinking, but that nevertheless is not mastered by a vast majority of highly-educated western adults. Consider four index cards with an *a* printed on one, a *b* printed on a second, a 2 printed on a third, and a 3 printed on the fourth. The experimenter places them on a table and makes the assertion that "All the cards with a vowel on one side have an even number on the other." The subject is then asked which cards should be turned over in order to check the validity of this assertion.

The correct answer is that the card with the *a* printed on it should be turned over (to check that there is indeed an even number on the other side) and the card with the 3 printed on it should be turned over (to check that there is *not* a vowel on the other side). Yet a vast majority of the subjects assert that the cards with the *a* and with the 2 should be turned over — even though anything on the other side of the card with the 2 is completely compatible with the statement. In fact, Wason (1968) reports that "from 60 to 75% make the incorrect selection (of 2) and that "only a minority select" 3. He concludes that his results are "disquieting." "If Piaget is right (Inhelder and Piaget, 1958), then the subjects in the present investigation should have reached the stage of formal operations. A person who is thinking in these terms will take account of the possible and hypothetical by forming propositions about them. He will be able to isolate the variables in the problem and subject them to a combinatorial analysis. But this is exactly what the subjects in the present experiments singularly failed to do. The variables in the present task are abstract but they are distinct and susceptible to symbolic manipulation. Could it then be that the stage of formal operations is not completely achieved at adolescence, even among intelligent individuals?" (p. 281)

I have informally replicated Wason's results with subjects who have Ph.D.'s in mathematical psychology! Only one of five subjects correctly solved the task. (I feel constrained not to reveal the names of these mathematical psychologists, but they are all well published and – at least in my biased estimation – highly regarded members of their field.)

What are we to conclude: (i) That the mathematical psychologists are incapable of formal thought? or (ii) That Piaget and Inhelder have a mistaken conception of the nature of formal thought?

My answer to both of these questions is NO. In this paper, I will propose a rather simple interpretation of Piaget and Inhelder's ideas about formal thinking, and this interpretation will reveal why it is that subjects occasionally do so badly on tasks meant to elicit such thought.

Briefly, I will argue for the following propositions:

1. The tasks presented by Piaget and Inhelder are all of the type that are most efficiently solved by truth-table analysis (combinatorial analysis).

2. *"Formal thought"* in the sense of Piaget and Inhelder involves *behaving as if* one were using a truth-table (i.e., performing a combinatorial analysis).

3. Formal thinking refers to an *ability*. The fact that this ability is not always used (e.g., in novel or emotionally-arousing situations) does not mean that it is not there. (In counter-positive form, the fact that someone possesses this ability does not mean that he or she will always use it.)

I claim no great originality for these three propositions. The first two may be found in the work of Flavell (1963), quoted later in this talk. The third – it has been suggested to me – is self-evident. The fact that adults do not always solve problems rationally without being "mentally ill!" may in itself be sufficient to demonstrate that "formal structures" must refer to abilities rather than to omnipresent thought styles.

Two Typical Problems

The role of invisible magnetization and the sixteen binary propositional operations. The problem (in ch. 6 of Inhelder and Piaget, 1958) consisted of determining why a metal pin attached to a non-rotating disc stopped with the bar pointing to one pair of boxes rather than any other boxes, placed round the disc. The board was divided into 8 sectors of different colors such that opposite sectors had the same color. The boxes could be moved to different sectors but were always placed with matched pairs opposite one another. The child had to determine why the metal bar always stopped in a position in which it was pointing to the boxes with a star on them. In fact these boxes had magnets concealed inside them, so that there was no systematic solution to the problem; that is, there is no solution involving color, weight, or position, singly or in combination.

So how does the child discover that the solution is arbitrary? The basic idea is that the young child just tries one hypothesis after another in an unsystematic manner. The older child

looks systematically at the color, weight and then a combination of the two, before deciding that the solution is arbitrary. Let us consider some of the protocols quoted by Inhelder and Piaget. (page 97) NAME (age 8:3) "It depends on whether you turn it faster or slower." He holds to this idea for a long time. "Maybe you turned it too hard," etc. Finally, since the needle always stops on the star: "It's because the (starred) boxes are heavier." "And these?" (the E asks, point to heavier boxes) "Maybe they are too heavy, so it doesn't work." GOU (age 14:11) "Maybe it goes down and here it's heavier (the weight might lower the plane, thus resulting in the needle's coming to rest at the lowest point) or maybe there's a magnet" (he puts a notebook under the board to level it and sees that the result is the same). "What have you proved?" "There is a magnet" (he weights the boxes). "There are some that are heavier than others (more or less heavy). I think it's more likely to be the content" (in substance). – "What do you have to do to prove that it isn't the weight?" He removes the diamond boxes which are heaviest. "Then I changed positions. If it stops at the same place again, the weight doesn't play any role, but I would rather remove the star boxes. We'll see whether it stops at the others which are heavier (experiment). It's not the weight. It's not a rigorous proof, because it does not come to rest at the perpendicular (to the diamond boxes). The weight could only have an effect if it made (the plane) tip. So I'll put two boxes, one on top of the other, and if it doesn't stop, that means that the weight doesn't matter: (negative experiment). You see." "And the color?" – "No, you saw when the position of the boxes were changed. The contents of the boxes have an effect, but it's especially when the boxes are close together: the boxes are only important when they are close (he puts half of the boxes at a greater distance). It's either the distance or the content. To see whether it's the content I'm going to do this (he moves the starred boxes away and brings the others closer). It falls exactly between the round ones, which are near, and the stars, which are far off. Both things have an effect and it's the result of two forces (experiment in which the star is moved away by successive stops). It's more likely to be distance (new trial). It seems to be confirmed, but I'm not quite sure. Unless it's the cardinal points (he takes off the stars). No, it's not that. The stars do have an effect. It must be the content. If it isn't a magnet, I don't see what it could be. You have to put iron on the other boxes. If the magnet is there (disk), it will come (to) these boxes. If it is in the boxes (stars), there is iron under the disk (he removes the starred boxes). I'm sure that it's the boxes."

This is not very systematic, but underlying his behavior is the idea of testing hypotheses about weight and color, etc. Inhelder and Piaget (1958) write (p. 102):

"We see here the great difference between substage II-B subjects, who are limited to serial correspondences or transitive equalities, and the stage III subject, who utilizes the formal combinatorial system and as a result does not experiment until he has made deductions from his preliminary hypotheses;" and (p. 104) (the subject understands) "complete affirmation or tautology $p^*q = (p\cdot q) \vee (p\cdot\bar{q}) \vee (\bar{p}\cdot q) \vee (\bar{p}\cdot\bar{q})$: all possible combinations, thus absence of particular links, for example, between the box which contains the magnet and the colored sector on which it has been placed."

"Centrifugal Force and Compensations"

"Three metal balls of different weights are placed on a disc at three different distances from its center. The disc is rotated faster and faster until the balls roll off the disc because of centrifugal force. The problem is to predict in what order they will leave their initial positions (and roll off) and why" (in ch. 14, p. 211, of Inhelder and Piaget, 1958).

The centrifugal force, f, is proportional to mr, where m is the mass of the ball, and r is the distance from the center of the disc. Thus, as the rotation of the disc is accelerated, the heavier the ball is and the further from the center it is, the sooner it will roll off. Inhelder and Piaget describe this as a problem in 'compensation.' A heavy ball near the center may be displaced at the same time as a lighter ball nearer the edge of the disc. This idea of compensation implies a psychological assumption (apparently tenable) that the child looks at how heavy the balls are (rather than how light) and at how close they are to the center (rather than how close to the edge).

Inhelder and Piaget describe the following sequence of reasoning from the young child to the adolescent: (1) The youngest children think the balls go off "because they want to." (2) At about 5 or 6 years old, the child understands that the speed of falling off is related to the weight of the ball and its distance from the center. Sometimes they hold one factor responsible, sometimes the other. They are unable to see that these factors are jointly involved. (3) The child is able to combine the two factors, but only if the two factors are working in the same direction, not in terms of compensation. Thus he understands that a heavy ball near the edge falls off sooner than a light ball near the center. (4) If the experimenter holds one factor constant, the child is able to specify the relationship of speed to the other factor. (5) The child decides for himself to hold one factor constant and vary the other. (6) The child understands the principle of compensation: a change in one factor can be offset by a (reverse) change in the other. (7) Finally, the child is able to state the principle of compensation in terms of a metric relationship.

To understand the metric formulation, we are looking at a sort of limiting case: If two balls fall off at the same time, how can we change the situation in such a way that we still have this equality. Let r_o refer to such a change. Then

$$r_o \longrightarrow p\bar{q} \vee \bar{p}q \ , \qquad (1)$$

where p refers to an increase in weight, q refers to a decrease in distance, etc.

hence $\frac{p_1}{\bar{q}_1} = \frac{q_2}{\bar{p}_2}$ ⟶ $\frac{\text{increase in weight}}{\text{decrease in distance}} = \frac{\text{increase in distance}}{\text{decrease in weight}}$

or $\frac{p_1}{q_2} = \frac{\bar{q}_1}{\bar{p}_2}$

or $\frac{p_1}{q_2} = R\left[\frac{\bar{p}_2}{\bar{q}_1}\right]$, (R is a reciprocal function).

This is expressed by Inhelder and Piaget as (p. 222): "For example the weight of the large ball is to the (greater) distance of the small ball is to the small(er) distance of the large ball." Note that the child behaves *as if* he is operating this way. He would be unable to make such a statement himself.

Truth-Table Analysis

To describe the model which represents the behavior described in these experiments, we must introduce the idea of a truth table. Given two statements p and q, both of which may be true or false, there are four possible combinations: pq, $p\bar{q}$, $\bar{p}q$, and $\overline{pq}$. Each of these combinations may itself be true or false. This yields $2^4 = 16$ possibilities which may be represented in a truth table:

Column No.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
pq	0	1	0	0	0	1	1	1	0	0	0	1	1	1	0	1
$p\bar{q}$	0	0	1	0	0	1	0	0	1	1	0	1	1	0	1	1
$\bar{p}q$	0	0	0	1	0	0	1	0	1	0	1	1	0	1	1	1
$\overline{pq}$	0	0	0	0	1	0	0	1	0	1	1	0	1	1	1	1

In this table, 1 and 0 represent truth and falsity respectively. Let us consider a few examples. (i) column 14: In this case, we never observe $p\bar{q}$. We conclude $p \Rightarrow q$. (ii) column 6: Here we observe only pq and $p\bar{q}$, but neither of the other combinations. This is equivalent to p. (iii) column 8: We observe only pq and $\overline{pq}$. This is equivalent to $p \Leftrightarrow q$. (iv) column 16: Here we observe all 4 combinations. This is equivalent to the tautology p^*q.

Thus a relation such as $p \Rightarrow q$ is logically equivalent to specifying one column of the truth table. Inhelder and Piaget's 16 binary operations consist essentially of using this truth table in two different ways: (i) As in Experiment I with the boxes: By identifying p with the independent and q with the dependent variable in the experiment, the child is able to understand the tautology. That is, he looks at the four possible combinations of p,q and observes them all. He concludes that there is no logical relationship between p,q, i.e., p^*q.

(ii) As in Experiment II with the balls falling off the disc: If p corresponds to "increase in weight" and q to "increase in distance," then 1's and 0's in the truth table may be interpreted as 'e' does or does not occur respectively (where 'e' is the event "the balls roll off at the same time".) The adolescent discovers that $e \Rightarrow p\bar{q} \vee \bar{p}\bar{q}$. Thus, he is behaving *as if* he had the truth table in his mind; he looks at all the possible combinations until he finds the column which fits his observations. Inhelder and Piaget conceive of these 16 binary operations in terms of a lattice (isomorphic

to the truth table). Turning the truth table sideways yields the lattice structure of Figure 1.
This gives us the lattice structure of Figure 1.

For each pair of operations there is a least upper bound, which is their union. For any two operations there is also a greatest lower bound which is their intersection. Hence we have a lattice structure. Thus to solve logical problems of this sort with a determinate solution, we can look at the four possible combinations of p,q systematically. This allows us to identify one column of the truth table and hence specify the relationship between p and q. This is equivalent to looking at the 16 binary operations or at the lattice structure. This structure can be generalized to the case with fewer variables or with more variables.

Consider the case of one variable. The two possibilities $p, \bar{p}$ give rise to $2^2 = 4$ possible operations which may be represented either in a truth table or in the simple lattice structure of Figure 2.

To quote from Flavell (p. 206): "Let us assume that the adolescent confronts a problem and, as a consequence of this new orientation, wants first of all to determine all the possible relations inherent in the problem so as to make sure that all can be tested for reality status, none overlooked. How is he to do this? What he does do – and this is the final property we refer to – is systematically isolate all the individual variables plus all the possible *combinations* of these variables. That is to say, he subjects the variables to a *combinatorial analysis*, a method which nicely guarantees that the possible will be exhaustively inventoried. The number of possible combinations of even a few variables can be quite large (4,16,256,4096). If A and B are two variables of which outcome X might be some kind of function, contingencies like the following need to be tested: (a) neither A nor B produces X alone nor in combination; (b) A elicits X but B does not; (c) B elicits X but A does not; (d) Both A and B can induce X, separately or jointly; (e) A and B together produce X but neither alone does; (f) A produces X if B is absent but not if B is present; and there are a number of other possible combinations whose empirical truth or falsity has to be tested before a causal analysis can be complete."

Later Flavell (p. 212) says (and this is stressed heavily by Inhelder and Piaget): "The essential attribute of formal thought is the orientation toward the possible and hypothetical. One manifestation of this orientation is the adolescent's tendency to explore all possibilities by subjecting the problem variables to combinatorial analysis."

Finally, Proposition 3 seems well established from the work reviewed by Ross, as well as the work of Wason. Proposition 3 also explains why it is that – as reported by Ross – there may not be high correlations across people between various measures of formal thinking. The fact that one has the ability does not mean that one always uses it. Hence, people who succeed at one task do not necessarily succeed at another.

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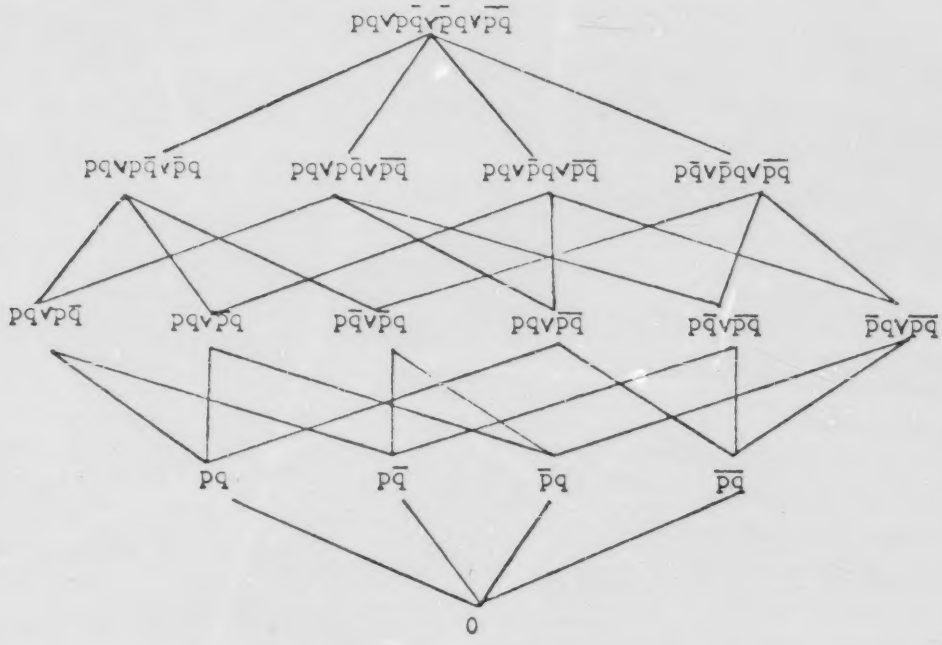

Figure 1.

Figure 2.

Piagetian Theory and the Development of a Model Curriculum for Young Children

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A mother, finding her young daughter gazing at the fish swimming in the fish bowl, asked her, "Why do you suppose the fish stay in the bowl rather than out here on the floor?" "Because they are afraid of the cat," responded the child. As adults we may be amused by such remarks of young children, but the work of Piaget has enabled us to be more insightful of children's language. We may still chuckle, but we are also alerted to the limitations of the child's thought, alerted to his inability to think causally in the way of an adult. We are reminded, too, that he is in the developmental stage Piaget defines as preoperational which approximates the years of two through seven. The discussion today is limited to this stage, more particularly to the 3-5 year olds, because I am describing the program of the USC Preschool. It is a program derived from general as well as particular concepts of Piagetian theory which seem to have implications for developing educational programs for preoperational children. With time limitations in mind, this paper is divided into two main sections: 1) the discussion of two general concepts of Piagetian theory with implications for program; and 2) the particular characteristics of preoperational children and these relationships to developing programs.

The first broad concept, a fundamental one to Piagetian theory, is his notion of knowledge. Knowledge is not a reflection of reality but a result of ACTIVE interaction between the child and his environment. Through his own actions the child learns to "know" the world around him. In some instances he learns to modify (or reorganize) it for his purposes. In other instances he learns how he must modify and adapt his behavior to the environment. He is busily engaged in developing an intellectual organization which is continually modified and reorganized as he grows and develops. This reorganization of thinking: 1) builds toward increasing complexity through continued interaction upon the child's environment; 2) is learned through his senses, and 3) is developed through use and through activities which demand that the child accomodate to the "new". Thus the process of "knowing" develops through the child's experience and within his social milieu.

The second major concept I will mention and one closely related to the knowledge concept of Piagetian theory is the notion of motivation. Piaget views it as intrinsic to intellectual functioning. Inherently the child is desirous of intellectual adaptation and organization. His neurological system is such that he strives toward mastery. Uncomfortable when his system is out of equilibrium he attempts to bring internal congruence to the dissonance he finds within his environment. This concept of motivation is what Robert White described as "motivation for competency". He explained it this way, "Given a situation of mild arousal the child will engage in a wide variety of activities because it is satisfying to him to deal effectively with his environment. The child will repeat the action until he masters it for his personal satisfaction".

What do these two general concepts imply for the development of programs for young children? First, the program must be action oriented if the child is to learn "to know". Secondly, the environmental setting must be one which facilitates the modification of intelligence. Included in the setting are such components as the following:

- Problem solving and answer seeking activities
- Exposure to a variety of sensory experiences and of novelty
- Diversity within the environment which encourages the child to organize his experiences in various ways
- A range of activities from simple to complex with multiple opportunities for greater "knowing"
- Time for self practice and decision making
- Interaction with adults who can provide corrective feedback, raise questions which evoke a range of mental activity on the part of the child, and support his exploratory activities

The balance of this paper is devoted to the particular characteristics of preoperational children as Piaget has defined for us. What are these characteristics?

1. He is the focus of his world. All space and time are centered on him, he thinks. He is unable to understand differing points of view from his own.
2. He believes what he sees, thus, he is a non-conserver.
3. His thoughts are tied to action. He has propensities for movement, for manipulation of objects as he engages in "oral thinking" (language), for exploration through his senses.
4. He is building the foundation for symbolically living with his world; he is learning to "represent" his experiences in a variety of media. How does this emerge? Piaget suggests five interrelated behaviors which give rise to symbolic representation. These five behaviors, appearing almost simultaneously but in an increasingly complex order are:
   a) Deferred imitation
   b) Symbolic play
   c) Drawings or graphic images
   d) Mental imagery, which Piaget describes as internalized imitation
   e) Language

Time does not permit for discussion of these behaviors; however I can refer you to a paper I presented in 1971 which discussed in detail these particular behaviors. (see references)

Now let us turn to the conditions and materials which are attuned to the patterns of thought natural to the preoperational child:

1. The use of materials which help the child to build feelings of competency and which center on him. Some examples are: photographs of himself at various activities, tapes of his voice, TV playback wherein he is his own model for imitation.

2. Opportunities and time for the child to repeat actions meaningful to him and to order his actions within an environment complex enough to make intellectual demands upon him.

3. Provision for play wherein he may adapt his play to satisfy his purposes. The use of blocks, sand, water, play houses, dress up clothes are time honored successes.

4. The inclusion of materials used to represent the child's concrete experiences. Wood construction, paints, clay, music, creative movement, reading to children, and taking dictation of their language are all necessary ingredients.

5. Provision for functional situations wherein he can emerge in a range of mental actions such as: recall, discriminate, classify, order, sequence, predict, etc.

Walking into such a classroom one possibly would not see much difference in the materials and equipment of our USC Preschool and a traditional nursery school. The difference lies in our purposes for the program: what we are learning about the development of children's intelligence, and how to make a better "match" between each child's past experience and his readiness for the next step in modifying his intellectual organization. It seems that the differences are analogous to what Piaget himself has done for us who have studied child behavior for many years. We know that children do and say the same things from one generation to the next and have done so for a good many years. Then Piaget came along and began to ask different questions about child behavior. When he did, he arrived at different answers. Thus he has made it possible for us to interpret child behavior in new and possibly more knowledgeable ways. Now we must ask ourselves, "What does the child do in his environment, and what does the environment do to the child?" Some day we hope to have some definitive answers.

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A Study of the Effects of a Structured Curriculum in Piagetian Type Operations on the Cognitive Coping of Elementary School Children[1]

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Recent interest in Piagetian theory and its implications for education has prompted increasing attention to the development of curricular material and techniques which attempt to strengthen cognitive processes as opposed to mastery of subject-matter content. This trend has created the cognitive-curriculum model.

According to Covington (1970), there is enormous potential value in the development of cognitive curriculums which directly strengthen the processes underlying productive thinking. However, all too often such attempts are open to a host of criticisms which are derived in part by the seeming artificiality of many of the mental skills taught, the contrived nature of the instructional procedures used, and the lack of evidence that cognitive training has more than a transient impact on regular classroom behavior. Covington feels that the basic difficulty stems from the cognitive curriculum being typically viewed as an exercise which is essentially "grafted" on to more traditional curricular practices as an afterthought. He suggests that before the student can derive maximum benefits from a strong "process-oriented" approach to education, it will be necessary to develop a curriculum model which has as one of its fundamental objectives, the strengthening of cognitive processes per se.

There are many new elementary-level curriculums which claim to foster cognitive growth as their primary goal. These have appeared particularly in the areas of mathematics and science education. One such curriculum is The Science Curriculum Improvement Study (SCIS), developed by Karplus and Thier (1967) at the University of California, Berkeley. This is a process-oriented program based primarily on Piagetian theoretical concepts, which attempts to strengthen concrete operations in latency-age children in preparation for the formal operational level of cognitive development.

Some investigators (Berlin and Franklin, 1961; Smedslund, 1961; Wohlwill and Lowe, 1962) have suggested that direct teaching methods (i.e. conservation training) do not facilitate growth in concrete operations. Rather, conditions for acquisition of mental operations must develop from within the child's own cognitive structure.

On the other hand, other investigators (Coxford, 1964, Sigel, Roeper and Hooper, 1966; Shantz and Sigel, 1967) have demonstrated significant advances in conservation ability when training is focused on those mental operations believed to be crucial prerequisites for the acquisition of concrete operations. Such training procedures have provided experiences with multiple classification, multiple relationality, reversibility and seriation.

These issues represent the basic rationale for this study. That is, there is a need to systematically study whether cognitive curriculums are actually able to achieve their objectives, and perhaps more basically, is it possible to demonstrate cognitive change in children by induced experiences. The intent of this research, therefore, was to investigate these issues by studying the effects of a structured cognitive curriculum (SCIS) on the cognitive coping of elementary school children.

METHOD

Subjects

The research sample consisted of 107 third-grade students in an elementary school in Oxford, Michigan. Two third-grade classes totaling 55 children (23 girls and 32 boys) comprised the experimental group while two third-grade classes of 52 children (21 girls and 31 boys) served as controls. The mean age of the experimental group was 8 years-8 months and the mean IQ was 107.8. The mean age of the control group was also 8 years-8 months and the mean IQ was 107.4.

Research Instruments

To measure the cognitive coping of the subjects the following instruments were used:

(1) *Cognitive Operations Test (COT)* - consisting of seven traditional Piagetian tasks which are individually administered and measure conservation attainment in children (adapted from McCormack and Bybee, 1970).

(2) *Concept Development Test (CDT)* - a group test developed by Freyberg (1968) based on Piagetian concepts of cognitive development. This instrument

[1] This paper is based on portions of the author's doctoral dissertation submitted to the Graduate Division of Wayne State University, Detroit, Michigan. The author is indebted to Juanita Collier, Ph.D. for the valuable assistance she provided with this study.

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consists of 72 pictorial items which measure the level of conservation, seriation, and classification attainment in children through related conceptual tasks.

(3) *Stanford Achievement Test (SAT)* - from the Primary II Battery the subtests of *Arithmetic Computation; Arithmetic Concepts;* and *Science Concepts* were used.

Research Curriculum

The Science Curriculum Improvement Study (SCIS) consists of six units in Physical-Science and six units in Life-Science. The entire program is designed to develop process-oriented concepts as well as scientific concepts.

The experimental treatment in this study was based on the *Material Objects Unit* of the SCIS Physical-Science Sequence. This unit was utilized because it emphasized process-oriented concepts related to the cognitive operations of classification, seriation and reversibility as opposed to factual content. The Material Objects Unit is structured to provide (1) "invention lessons", involving activities of defining and labeling new concepts and (2) "discovery lessons", designed to let the child manipulate materials, broaden his background of experience, and apply new ideas.

There is a total of 21 activities presented in the Material Objects Unit. These activities utilize numerous objects and materials (provided in a kit) to actively involve the child in the processes of observing, describing, comparing, ordering, classifying, measuring, interpreting evidence, and experimenting.

Experimental Procedure

The initial step in the study was to obtain pre-test data in regard to the current cognitive coping of all subjects. All group tests were administered by the investigator with the classroom teacher assisting as monitor. The Piagetian tasks were individually administered to the subjects by the investigator and three educational psychologists from the Oakland Schools Intermediate School District. All test administrations followed standardized procedures.

During the pre-test period, the teachers of the experimental group received orientation and inservice training in the use of the SCIS curriculum. The control group teachers received comparable inservice regarding general educational discussions and traditional science curriculums.

The next step was to introduce the experimental treatment. The experimental group utilized the Material Objects Unit for a period of ten weeks, which consisted of a total of thirty sessions occurring on Monday, Wednesday and Friday of each week. Each session was forty minutes in duration. The teachers of the experimental group met weekly with the investigator to develop specific daily plans so that consistent instructional approaches would be maintained between experimental classes. The plans were based on the published teacher's guide for the Material Objects Unit.

During the same ten-week period, the control group spent comparable exposure time on a traditional content-oriented science curriculum. This curriculum was based on a third-grade textbook, *Science Far and Near.* The control group studied those chapters of science content that were most similar to content in the experimental treatment (i.e., Learning About Rocks; The Earth's Surface; and Machines at Work). The investigator also met weekly with the control group teachers to coordinate instructional approaches and content coverage.

Both experimental and control group teachers were advised not to compare or discuss their respective science instruction during the ten-week period. According to the principal of the school, all of the teachers in the study were comparable in their general instructional approaches and classroom management.

At the end of the ten-week period, post-test data were obtained to again measure the cognitive coping of the subjects. It was predicted that the experimental group would show greater gain-scores on tests of cognitive coping than controls. Based on a 2 X 2 factorial design the data were examined by an analysis of variance for group differences regarding sex and treatment.

RESULTS

Table 1 presents the F-values related to differences in mean gain-scores between experimental and control groups for each dependent measure.

Subjects exposed to the Material Objects Unit made significantly greater gains on the COT (Piagetian tasks) than subjects exposed to the traditional science curriculum ($F = 15.091$, df. = 1/103, $p = < .01$). Since the COT consisted of seven different Piagetian conservation tasks (i.e. quantity, length, area, volume, etc.) a closer examination was warranted to determine if gains were consistent across all tasks. A chi-square analysis was performed between experimental and control groups for each task, with conservation gains versus no gains as the dependent variable. The results showed that a greater proportion of experimental students made gains on each of the seven Piagetian tasks. However, only gain-scores related to the conservation of *length* showed a statistically significant difference in favor of experimental subjects. This finding is presented in Table 2.

While experimental subjects gained more than controls on all conservation tasks of the COT, it was established that conservation of length made the single greatest contribution to the overall significant difference between groups.

Returning to Table 1 it is noted that there was a general trend for experimental subjects to show greater gains on the CDT than controls, but the difference was not significant. The analysis of variance however, did show a significant

TABLE 1

F-VALUES OF DIFFERENCES IN MEAN GAIN-SCORES BETWEEN GROUPS FOR EACH DEPENDENT MEASURE

MEASURE	GROUPS	MEAN GAINS	F
Cognitive Operations Test (COT)	Experimental	2.22	15.091**
	Control	1.04	
Concept Development Test (CDT)	Experimental	7.33	2.900(NS)
	Control	4.83	
Arithmetic Concepts	Experimental	7.33	7.919**
	Control	2.75	
Arithmetic Computation	Experimental	7.71	1.556(NS)
	Control	6.10	
Science Concepts	Experimental	0.97	0.272(NS)
	Control	0.73	

** Indicates F-Value Significant Beyond .01 Level

TABLE 2

CHI SQUARE ANALYSIS OF GAINS IN CONSERVATION OF LENGTH

	EXPERIMENTAL GROUP	CONTROL GROUP	X^2
Gain	27	14	7.180**
No Gain	14	25	
TOTALS	41	39	

** Indicates X^2 value significant at .01 level.

TABLE 3

TESTING FOR SIMPLE EFFECTS IN GAIN-SCORES ON THE CONCEPT DEVELOPMENT TEST (CDT)

Combinations of Groups by Sex	N	Mean Gain	df	t
Experimental Boys	32	8.72	53	2.164*
Experimental Girls	23	5.39		
Experimental Boys	32	8.72	61	3.213**
Control Boys	31	3.68		
Control Boys	31	3.68	50	1.760
Control Girls	21	6.52		
Experimental Girls	23	5.39	42	0.713
Control Girls	21	6.52		

* Significant at .05 level
** Significant at .01 level

interaction effect at the .01 level of confidence ($F = 7.235$, df. = 1/103). To analyze the nature of the interaction, t-tests were applied to the data and the findings are presented in Table 3.

The interaction obtained in gain-scores on the CDT was primarily related to experimental boys. They scored significantly higher than experimental girls ($p = < .05$) and control boys ($p - < .01$). No significant differences were found between control boys and control girls or between control girls and experimental girls.

Further examination of Table 1 shows that the experimental group made significantly greater gains than controls ($F = 7.919$, df. = 1/103, $p = < .01$) on the Arithmetic Concepts Test. Thus, those students exposed to the Material Objects Unit showed greater growth in concepts of counting, numerical ordering, measurement, place value, etc. and greater development of mathematical operations associated with problem solving. This finding did not hold true in regard to Arithmetic Computation and Science Concepts as gain-scores on these subtests were not significantly different.

DISCUSSION

The results of this study indicate that when third-grade children are exposed to a curriculum which provides experiences in mental operations such as classification, relationality, reversibility and seriation, significant cognitive gains can occur. This was particularly substantiated by increases in conservation ability and arithmetical concepts.

It is interesting that trainin in mental operations considered to be prerequisites to conservation attainment (i.e. classification, relationality, reversibility and seriation) accelerated conservation growth in students who were already conserving. According to Piagetian theory, most children at the age of subjects in this study (8 years-8 months) are able to conserve at some level. The data in Figure I verify this as over 75% of the subjects were able to conserve mass and liquid on the pre-test.

The number of children conserving would indicate that most subjects had well established prerequisite mental operations. Therefore the training procedure apparently provided meaningful experience and practice which strengthened those prerequisite operations and thus accelerated further conservation development in experimental subjects.

The findings support previous research which employed group training procedures in prerequisite mental operations. Coxford (1964) found that group experiences in serial ordering, serial correspondence and ordinal correspondence were effective in conservation development. Sigel, Roeper and Hooper (1966) developed a structural teaching method for multiple classifications, multiple relations and reversibility. The children in their study were encouraged to label and identify multiple characteristics of objects and

substantial gains on conservation tasks were found for experimental subjects after only three weeks of training. Shantz and Sigel (1967) showed that training in discrimination of action sequences and visual details as well as labeling characteristics of objects and learning classification skills, induced cognitive gains.

Current results particularly support a study by Stafford (1969) which had a design very similar to this study. After one semester of SCIS exposure, Stafford's experimental group showed greater gains in conservation skills than did controls. Gains on two conservation tasks, number and length, were significant at the .01 level of confidence.

Other evidence in this study supports the Piagetian notion that conservation attainment progresses in an age-related order depending upon the level of difficulty of the concept. Findings by previous investigators (Elkind, 1961; Lovell and Ogilvie, 1960, 1961; Smedslund, 1961; Uzgiris, 1964; Kooistra, 1963; McRoy, 1967) have demonstrated that conservation of number appears first, then quantity, weight and volume. Although the sequence is not entirely clear, conservation of area and length occur sometime after quantity and before volume. The data in Figure 1 support this finding. It appears that the particular third-grade subjects in this study may have been in a transitional stage of length conservation. This is based on the substantial gains made by experimental subjects in length conservation, which at this time, was apparently the most sensitive conservation skill to the training.

A somewhat confusing effect was observed in gain-scores on the CDT which is a "paper and pencil" group measurement of Piagetian concepts. Sex differences throughout the data were remarkably absent. However, only experimental boys made significant gains on the CDT (see Table 3). Apparently an unknown variable either inhibited experimental girls from making comparable gains to those of experimental boys, or accounted for the control girls' accelerated concept growth in the absence of the experimental treatment. Further research is needed to clarity this result, but at this point it can be concluded that only experimental boys showed a significant effect from the training on CDT measures.

Based on the logico-mathematical nature of Piagetian concepts, it was assumed that the effects of training in prerequisite mental operations should transfer to arithmetic ability. The results showed a more clear-cut effect on arithmetic concepts than on arithmetic computation (see Table 1). A closer inspection of the data disclosed a variable that may have interferred with significant differences in arithmetic computation. Table 4 shows mean gain-scores in arithmetic computation for each class. A t-test application revealed that experimental class 1 made significantly higher gains than experimental class 2 and both control classes. In analyzing the arithmetic computation test results it was found that subjects in experimental class 2 typically scored poorer on post-test subtraction problems than they had scored on pre-test subtraction problems. The teacher of the class indicated that this may have been related to the fact her students had not been exposed to subtraction review for approximately five weeks. All of the other teachers indicated that subtraction review had been part of their weekly instruction in arithmetic. It is possible that this intervening variable, the absence of review in subtraction, may have canceled out the effects of training on arithmetic computation for the total experimental group.

In regard to the significantly higher gains on arithmetic computation by experimental class 1, there was no evidence to indicate that this particular teacher treated arithmetic instruction any differently or with greater expertise than any of the other teachers (with the exception of the absence of review sessions in experimental class 2). Therefore is was concluded that those computation gains exhibited by experimental class 1 were related to exposure to the Material Objects Unit. Assuming this was true, it appears that a combination of practice in arithmetic skills and exposure to relevant mental operations can induce significant gains in arithmetic computation.

The results clearly showed significant gains in arithmetic concepts for the total experimental group. This transfer of training to arithmetical "thinking" supports previous evidence (Dodwell, 1962; Hood, 1962; Almy et.al., 1966; Nelson, 1970; Karminsky, 1970, Swize, 1972) that has demonstrated significant correlations between conservation

TABLE 4

MEAN GAIN-SCORES ON ARITHMETIC COMPUTATION FOR EACH CLASS

Class	N	Mean Gain
Experimental Class 1	27	11.52
Experimental Class 2	28	4.04
Control Class 1	26	5.23
Control Class 2	26	6.96

abilities and arithmetic achievement. These findings also corroborate those of Coffia (1971) who investigated achievement patterns of fifth grade students that had been exposed to the SCIS program since the first grade. He found that SCIS students scored significantly higher in mathematics applications than non-SCIS students.

Since the SCIS program is presented as a science curriculum, it was felt that a science measure should be used to examine any effects the training might elicit in relation to science achievement. Actually, significant gains in Science Concepts were not anticipated since this particular subtest focuses heavily upon word-knowledge in science as opposed to scientific processes. The results showed no significant differences between experimentals and controls on the Science Concepts Test. In fact, mean gains for both groups were less than one full point. Therefore, as anticipated, the Material Objects Unit did not influence the development of science vocabulary and facts since the objective of the curriculum is to develop science processes.

There is a need for the development of suitable evaluative criteria related to science processes. Weber (1972) recognized this need when he investigated the effectiveness of the SCIS curriculum in developing science processes. He designed and validated a process instrument based on tasks of observation, classification, measurement, experimentation, interpretation and prediction. Significant differences in scores on this instrument were obtained between SCIS and non-SCIS students in favor of the SCIS group. Weber's conclusion was that the SCIS curriculum is a superior educational program for developing science processes. Unfortunately, the only support the current study can provide for this contention is that the Material Objects Unit does not lend itself to the traditional objectives of teaching science facts and terms.

SUMMARY

In summary, the findings of this study indicate that children who are exposed to the Material Objects Unit of the SCIS curriculum show significant advances in cognitive coping. Such gains are particularly evident in Piagetian conservation tasks and arithmetical concepts, and appear to be related to training experiences in prerequisite mental operations.

The major implication of this study is that a concerted effort in the research, development and application of cognitive curriculums is needed. There is growing evidence that group training in cognitive operations can enhance cognitive growth, particularly when the training is independent of a given subject-matter discipline. Most efforts in the development of process-oriented programs have consisted of "attaching" cognitive experiences to a traditional content-centered approach. This procedure may have merit but in most cases unfortunately, the content experiences far exceed the cognitive experiences. Apparently the influence of tradition has created some resistance to offering a child experiences in school that do not carry a subject label. It was felt that the success of the training in this study was due to the fact that the Material Objects Unit primarily provided cognitive experiences even though it was labeled a science program. It seems therefore, that a greater emphasis on the development of curriculums which provide cognitive experiences per se, is warranted. What better objective can education develop than to provide learning experiences in which the content is the thought process itself; and the goal, the development of thinking.

Individualizing the Social Studies: An Application of Piaget's Theory

Barbara Z. Presseisen, Ed.D.

I. *Introduction: The Problem*

The fact that we are meeting here today acknowledges that Piaget has become an important influence on curriculum in American education. Every curricular area – science, mathematics, reading and the language arts – has been affected by Piaget's theory. The social studies is no exception. Taba's Contra Costa County program developed here in California and Bruner's "Man, A Course of Study" are well known for their roots in Genevan research. The important issue is how Piaget's theory is being applied to the curriculum. What ends are served by adapting cognitive theory to the development and implementation of the so-called "new social studies"?

One may argue that applying Piaget to the social studies is a natural step. There have been historical precedents pointing in this direction. From John Dewey's progressivism to the core curriculum of two decades ago, both an activity-based curriculum and an interdisciplinary social studies were logical forerunners of applied cognitive theory (Overton, 1972). What makes Piaget relevant to social studies in the late 1970's? The Social Encounter And Research Curriculum for Humanization, or SEARCH, applies Piaget to social education by emphasizing the individualization of instruction. It is our contention that cognitive-developmental theory, as expressed by Piaget and researched by many international scholars (Kohlberg, 1972), is consistent with the current concern for individualization in curriculum development. SEARCH is the first innovative curricular program that strives to teach the major concepts of the social studies at the same time it seeks to structure these concepts into an individualized instructional design based on Piaget.

To Piaget (1970), learning, or more broadly development, is the result of changing cognitive structures. This development occurs as the child's mental organization becomes a more complex and more efficient representation of the reality which he has actively experienced. Piaget's (1973) emphasis is on action; the child acts upon the objects he observes and in so doing he learns the nature and significance of those objects. He learns as an individual, in terms of the history of his past experience and in terms of the nature of his present activity. In Piaget's theory, the stage of the child's mental development at any given moment is of major consequence to the quality of his learning at that particular moment. The curriculum must provide for these individual concerns if the ends of learning are to be served. Even more important, an analysis of how the individual's development relates to the structure of the curriculum itself must also be made. Piaget's theory may enlighten such an analysis.

The central problem of this paper thus emerges: How can Piagetian principles be incorporated into an individualized social studies curriculum? The problem is one of application of Piaget's fertile theory. In actuality, this problem has grown out of a curriculum development project currently being conducted at Research for Better Schools, Inc., in Philadelphia. RBS is a non-profit research laboratory known for its various programs in individualizing and humanizing the curriculum. SEARCH is one of the components of RBS's Individualizing Learning Program, a program funded by contract with the National Institute of Education. SEARCH is being developed and tested with a Piagetian base constantly in mind. From selecting the concepts in the disciplines, to setting instructional objectives and producing the actual media of instruction, Piaget's theory and the concern for individual differences both guide the developers' work. In their experience, a fruitful base for pursuing the analysis mentioned above can be sought. As one of the major developers of SEARCH, I should like to share with you some of our observations and findings in applying Piaget to an individualized social studies curriculum.

II. *Piaget: Rationale for a Curriculum*

First, we must take a careful look at Piaget's pedagogical principles, reluctant as he may be to state them as dogma. Reference has already been made to the role of action which lies at the base of the child's development. Here Piaget's epistemological roots are exposed, for it is the nature of knowledge as he sees it that determines the child does not merely copy reality, he must operate upon it. Therefore, according to Piaget (1964), thought is the internalization of an operation.

Tied to his view of active participation in learning, Piaget has established an optimum role for the learner, as well as a principal goal of education: " . . . to create men who are capable of doing new things, not simply of repeating what other generations have done – men who are creative, inventive discoverers (Duckworth, 1964)." There is a spontaneous side to active learning, not a mere reflection of facsimile. To Piaget, the child must be able to go beyond information presented in a text or lesson. That is the true characterization of human intellect. The child must see the logic of material but also its greater significance. Moreso, if the lesson is to be meaningful to the student, it must be rooted in something he already knows and is concerned with, yet be dissonant or interestingly incomplete enough that he is motivated to find out more about it. There are then, according to Piaget, both cognitive and affective dimensions to the activity that inspires learning.

The concept of stage is another important principle that is central to Piaget's theory (Inhelder, 1953). Piaget has long maintained that the development of intellect follows a fixed and regular sequence of operations available to the youngster. Although each child may develop at his

own individual rate, the sequence of the stages of mental organization through which his activity will take him is the same for all individuals. Various research studies have corroborated this principle of Piaget's theory.

Of prime importance to Piaget's concept of stage is the fact that the various stages are characterized by the nature of their mental operations or their underlying cognitive structure. It is not merely chronological time nor the outward manifestation of an experience that is significant to a child's learning. Rather, the stage a child is in at a chronological moment determines the ways in which he can react to a given experience. Piaget's stages are adaptive; they indicate structures already available by which the child can assimilate new data. The stages are also dynamic; they indicate the potential for change in mental structures by which the child will accommodate and learn the new data.

Therefore, at different stages, Piaget suggests the child sees the same experience with different frames of reference or meaning. Given a measure of freedom to exercise fully the operations of a specific stage, the learner will integrate or internalize an experience by bringing the operations available to him to bear upon that experience. Eventually, by means of this intellectual interaction, the operations themselves will be transformed into a new stage, one characterized by more complex operations.

I will assume that you are familiar with the four main developmental stages suggested in Piaget's theory. They have received extensive description in the literature. The sensorimotor period provides the basic model of adaptation and the establishment of an object concept in the first two years of a child's life. Pre-school and primary education begin when the pre-operational stage influences the student. Piaget underlines the importance, if not dominance, of perceptual development during this period: the significance of imagery, the slow emergence of symbolic language, the largely self-centered orientation of the five to seven year old who believes what he sees rather than what he knows. In the next period, the direct action of concrete operations is necessary, in Piaget's viewpoint, to establish the conservation patterns in time, space, and causality which are the major mental feats of the developing child between the approximate ages of eight and eleven. This middle school child sees what he knows; the concrete images reinforce the logical patterns he now discerns. If permitted, the maturing adolescent in the next stage will begin to predict from these patterns, and in his prediction formal operations will be born.

Upon examining stage development, one is struck by the myriad of influences that an individual child doubtlessly brings to his changing mental structures: the role of motor control and muscular development in the first period; the impact of pattern recognition, contrast, symmetry, and memory on the second; the significance of manipulation, coordination, and differentiation on concrete experience; the importance of language development, divergent behavior, and confident risktaking at the formal level. Piaget's theory offers a new way, a much fuller explanation of the genesis of thought. Perhaps he enables the educator for the first time to view the child's mind as it actually is, or as it really develops, rather than in the monolithic what-it-ought-to-be form which has dominated education for so long. Educators have come to realize through Piaget's theory that the child gradually develops into a thinking adult. Unlike Athena, children are not born fully capable of formal operations. Inevitably, this realization will influence the relationship that exists between student and teacher in the educational setting.

In one sense, Piaget's model of an ideal student is "a doubting Thomas." For, he suggests, "the second goal of education is to form minds which can be critical, can verify and not accept everything they are offered (Duckworth, 1964)." Piaget takes issue with Dante who unquestioningly accepted Virgil as the fount of all wisdom. To put it into Bruner's words, teaching is not telling — that is to place at the level of rote memorization man's most creative role. Rather, according to Piaget, it is the teacher's task to facilitate learning in the sense of helping the student fully realize his own cognitive operations. By and large, it is the curriculum which provides the data upon which the student will act.

> We need pupils who are active, who learn early to find out by themselves partly by their own spontaneous activity and partly through material we set up for them . . . This is attained by a mixture of discovery and subtly controlled structure, leading through the natural succession of phases (quoted in Hechinger, 1972).

We come here to the structure of the subject matter itself and the relationship between this structure and instruction. In traditional education, the teacher is supposedly an expert in some area of knowledge in which society or an established council has deemed it necessary the student learn. Given the principles of education we have just discussed, the role of action and the importance of stage operations, what happens to this traditional view and the disciplines of knowledge in a Piagetian based teacher-student relationship?

To answer this question it is necessary to point out that Piaget depicts knowledge as a molar entity, synonymous with conceptual wholes. Such a position enables Piaget (1970) to speak of interdisciplinary relationships among subjects. The division of compartmentalized subject fields within knowledge is a scholarly convenience, according to Piaget, perhaps a limitation needed for realistic research, but not an intellectual necessity. Piaget is moved more by the parallel structures or patterns cutting across the disciplines than with fragmentary conceptualizations of adult thought in varied academic fields (Presseisen, 1971). For purposes of instructing young minds, Piaget concentrates on the significance of a single logic basic to all knowledge, rooted

in a uniform sequence of cognitive operations. The age old curriculum dichotomy of content or process is obliterated by Piaget's view of developing knowledge. In his view, it is the relationship between content and process, or as Kohlberg calls it Piaget's "interactionist epistemology," that should become the focus of the curriculum.

Thus, in the social studies Piaget asks such questions as, "How does the child develop concepts of history or anthropology?" Rather than to speculate on the nature of history or anthropology or any other discipline, Piaget assigns the instructor the task of studying how his students learn a particular subject. This is not to say a teacher should not be concerned with the fine points of the content. Knowing more about a discipline can only help him relate it to the process base. Even the disciplinarian, the historian or the anthropologist, can learn by observing the cognitive operations demanded by his subject field; he can more fully understand through these operations the theory of his intellectual pursuit. Piaget suggests that what is significant, however, is not the particular answer a student gives to a query in the subject matter, but the question the child thought he was answering. Therein lies the real relationship between the learner and the subject. Error in the student's response to a particular question represents the lack of cognitive communication among the student, the curriculum, and his teacher. The teacher's task is to bring these three factors into clearer communication. Once more, it is individual development upon which Piaget's theory centers. For the individual child's capability at the given moment is the most significant factor of the instructional exchange. Above all, it is this development that is key to writing a curriculum.

III. *An Individualized Program: SEARCH*

Let us now turn to the concern for individualizing instruction we mentioned earlier. According to Canfield and Brown (1971), individualization stems largely from an appreciation of differences among individuals. Individualization also arises from recognizing several manifestations which tend to personalize learning. What are these manifestations?

Individualization must be concerned with the rate by which a student learns, the pace he maintains, and the time he requires to work through a problem. At the same time, individualizing a curriculum requires that various cognitive levels and alternative modes of instruction be available to the learner. Phillips (1972) points out that a curriculum based on Piaget and serving the individual student, which he agrees Piaget would want, should provide each student with his own equipment for learning so that he can proceed in his direction and at his own pace. This suggests acceptance of the concepts self-instruction, self-initiation, and self-direction in learning, for one can hardly expect the teacher to be the primary mover of a classroom of twenty or more students, each studying different materials with a different array of multi-media devices to aid learning. Lastly, individualization implies testing techniques which permit assessment in terms of particular goals or specific objectives that are geared both to the pace of the individual's learning and the appropriate cognitive level at which he operates.

As I mentioned earlier, SEARCH is an individualized curriculum in social education that is Piaget based. We are in the process of wrangling with the problems of developing and testing an elementary program that provides for all the individualizing criteria just mentioned. Needless to say, our problems are all economy sized. But we feel the attempt is well worth the effort. With the opportunity to test our material in actual classrooms while we write the lessons, with the role of creating the media we use, as well as having an appraisal staff to critique both our students and ourselves, we are getting some very interesting returns on the viability of our basic design. Briefly, we are trying to create a model of what Glaser (1972) would call an adaptive educational program emphasizing the process variables central to Piaget. I shall have to leave the final judgment of our success up to you.

First, I'll explain how we have organized our curriculum. SEARCH organizes the thirteen years of a student's educational experience around developmental levels and life functions. Four Levels are premised in the total SEARCH program. Each Level is designated by the approximate age range and the gross cognitive operations characteristic of students within that range. Level A covers the five to seven year period, the cognitive operation is that of pre-operational thought. Level B includes the approximate ages of eight to eleven and is characterized by concrete operations. The SEARCH project concentrates on developing the elementary program in the next three years, but our design accounts for the period beyond elementary education, as well. Level C marks the ages twelve to fourteen and will focus on the transition to early formal operations, while in Level D the fifteen to eighteen year age group will be included with formal operations as the cognitive basis of instruction.

In addition to cognitive dimensions, and recognizing that Piaget maintains that affective concerns are never independent of cognition, we have also characterized the social parameters of each Level in SEARCH. Initially, in Level A the child is primarily self-centered in his social experience. Although Piaget has shunned away from using his term "egocentric," the pre-operational child still initially sees the world in which he lives through his personal vantage point. So we have constructed his social experience in our first Level. In Level B the child will become aware that others have views both different from and similar to his own, and he will become cognizant of the influence of group orientations on his own views. By Level C the child will widen his social perspective and see the possibilities of inter-group relationships and conflicts in his much more complex world. And finally, when he can think hypothetically and predictively, he will become conscious of the ideational relationships

of a complex society with values and mores as varied as the total possibilities of the human condition. It should be noted, these are gross organizers for a curriculum. Research does not permit us at this time to be more exact, nor more explicit. What should be underlined is the fact that the organizers come from theories of development, Piaget's and to some extent Erikson's, which describe the child as he is and becomes, not merely as he ought to be.

How do we account for content in the SEARCH design? Content in SEARCH is organized around five psycho-social functions. These five functions are 1) Self-Realizing, 2) Governing, 3) Producing and Consuming Goods and Services, 4) Utilizing Environments and 5) Generating and Interpreting Ideas and Events. The functions reflect the fact that human action and awareness begin with a personal focus and expand, as cognitive development, toward a focus on all humanity. The functions are organizers, too. SEARCH has chosen to be an interdisciplinary social education program, organizing material around concepts from the various social sciences and history, but emphasizing a dynamic approach to knowledge. This approach strives to have the student encounter the material he studies in the daily exchange between himself and his personal, social, and cultural environments. The emphasis in SEARCH is thus not to be [illegible] line based but activity oriented. Given a pa[illegible], or a concept to be mastered, we must write [illegible] activity that will cause the student to do something about [illegible]. The activity is to be written so that the student [illegible] at his cognitive level on the given problem. Hopefully, the activity will also be written to make it possible for the student to experience maximum flexibility and choice in pursuing his interests and concerns. This means the student must manipulate materials himself, and with each SEARCH lesson comes an appropriate materials kit that presents the perceptual as well as the conceptual base to his learning.

In SEARCH, Levels are further divided into instructional time segments called Stages. A Stage roughly corresponds to a grade in conventional schooling, but since cognitive operations are kept constant across Levels, we view SEARCH as a nongraded program. There are ten Units in each Stage of SEARCH, thus the three Stages in Level A represent thirty Units. We have mandated that the five Functions appear throughout a Level to give the integrated basis of a social education program, therefore in any one Stage there are approximately two Units based on each Function.

What does a SEARCH Unit look like? A SEARCH Unit contains several activities built around the Unit theme which, in turn, relates to the overall Function. In Level A, each Unit represents approximately nine days of instructional time, a half hour per day, including time for testing and recording student response. Each Unit includes a generalization, three concepts, and three objectives for instruction. Each Unit of SEARCH has been developed according to an original management system consisting of three Phases: Encounter, Research, and Action. Encounter consists of activities that introduce a Unit and concentrate on the development of the child's image and language for the material of the Unit. One can see Piaget's influence on this initiating entry into a lesson. Research emphasizes the active investigation and exploration of a particular problem. Here Piaget would find the manipulative examination by which mental structures can be expanded. And finally, Action asks the child to produce and demonstrate his knowledge of the concepts of the Unit. Practice follows acquisition of a concept, and the child is encouraged to share his learning with his peers in a mode of exchange that is not merely verbal and in a way that is both personal and creative as well.

Curriculum developers face the problem of how to test and properly pace their lessons. In trying to individualize SEARCH, we have compounded that problem. I can only give you our tentative solution to a management design, for we are still very much concerned with the problem. We have set a diagnostic measure at the beginning of a SEARCH Unit. This measure determines if a student is ready for the Encounter or Research Phase of the Unit. If his language and imagery are sufficient, he student can skip Encounter and go directly to Research. In both Encounter and Research there are two activities from which the child can choose as he wishes. These activities are instructionally equivalent, they differ only in media. We have attempted to make the activities as independent of teacher intervention as possible. Much of the instruction is handled by cassette tape, as in Level A we do not presume a reading ability on the student's part. We are looking into the possibility of making the student a more self-correcting learner, independent of the teacher for praise or reprimand. And what role do we assign to the teacher? The task of facilitator: to see if the student is having difficulty in a Research activity and needs recycling back to an Encounter lesson; to monitor the Action phase and to keep record of student performance; to help organize the multi-media materials for optimum use and encourage students in selecting new Units as they complete earlier ones.

Thus far we have been moderately successful in integrating social studies concepts with cognitive operations. Much of Level A material deals primarily with Piaget classification tasks, one-to-one correspondence of properties, multiple properties in a set, beginning class inclusions. In a Unit on feelings in the Self-Realizing Function, children at the Kindergarten Level, SEARCH's Stage I, learn to classify facial expressions in terms of emotional feelings being studied. Simultaneous membership in two classes teaches a second grader that one man can be both a producer and a consumer of goods and services. In all Units of Level A, the multimedia materials — games, puzzles, graphics, slides and tapes — have been the chief means by which instruction takes place. The materials have been enthusiastically received by the children. I might say that they have helped us convince the teachers, too, of the innovative worth of an individualized social studies program, no doubt evidence of the fact that the enjoyment of concrete operations persists into adulthood.

We are by no means finished with our appointed task. In some ways, we have merely found new questions and new problems. But applying Piaget's theory to an individualized social education program seems viable and very desirable. Our SEARCH staff is assured that social studies will never be quite the same.

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A Response to Furth's *Piaget for Teachers*

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INTRODUCTORY REMARKS: Within the past few years educators have begun to examine the work of Piaget with considerable interest. Many have made attempts to explore his writings and experimentations questioning the implication of Piaget's though as it relates to educational practices. Notable among those is Hans Furth who has written a book called *Piaget for Teachers.*

Dr. Furth writes his book as if he were carrying on a running correspondence with a teacher. Each chapter is written in the form of a letter. We have chosen his form to respond to the thoughts in his book.

Although familiarity with his writing might enrich one's understanding of our "letter," we have tried to clarify our interpretation of Furth's thought within the context of our writing. We wish to stress that our letter is meant to communicate our understanding of Furth's ideas; that we do not wish to imply that our school is a model of Furth's ideal translated into a reality.

What we describe is our classroom and we are encouraged to find support for some of the things we are doing in the thoughts of another educator.

Dear Professor Furth,

For the past few weeks our teaching team has been reading and discussing your book *Piaget for Teachers.* The three of us have found all of your letters exciting and stimulating for several reasons, chief of which is that we are presently teaching in a school that we feel is developing into a living example of what you call a "school for thinking." Our school is the Campus School at State University College in Plattsburgh. It is experimentally oriented, drawing its enrollment from the city of Plattsburgh and surrounding townships. Pupil selection is based on a lottery system so our school population is composed of children from a wide range of socio-economic backgrounds.

In your final letter you answered, in skeleton form, the question you had posed in your first letter, that is, "What kind of school is psychologically and socially suitable for the children of today?"[1] You suggested that the structure of such a school should grow from an understanding of the child, his intellectual development, and the manner in which he learns. On the basis of your earlier letters it also seemed implicit that an active physical involvement is imperative for children who have not yet reached the formal operational stage, which evolves at approximately ages 11-13. It would, therefore, seem crucial, if the goal is fostering intelligent behavior, that the school setting simulate active exploration of the child's entire environment, especially up to the age of 11.

It was gratifying and encouraging to read your conclusion on the teaching of reading. When you proposed that reading be relegated to an elective activity, since before a child reaches the stage of formal operations it is "a specialized skill which . . . has very little to do with thinking,"[2] we nearly applauded. From our teaching experience with a multi-age group of 4-7 year olds, we have come to the same conclusion. However, your exploration of that particular facet has helped us to expand and clarify our own rationale for freeing the children to work on reading as a choice among other options.

Now let us briefly describe our setting so that we can share some of the ways we see our children living out many of the ideas described in your letters. Over a two and a half year period three of us have worked, taught, and learned together in a classroom with fifty-four youngsters. We have experimented, modified and changed various aspects of our program as we have watched the children respond and grow with us. We have approximately equal numbers of 4's, 5's, 6's, and 7's in our group and have made attempts, in the design of our program, to provide a wide range of choices to meet the needs of all the age levels. This has not been nearly the problem that it might seem at first.

Our setting includes all of the material one would expect to find in a well equipped kindergarten or nursery classroom. There are large and small blocks, dress-up clothes, playhouse furniture, puzzles, games, books, musical instruments, a cooking corner, several varieties of live animals, work benches, tools, art supplies. We also have a room devoted to large muscle activity that all the children may use freely for approximately an hour and a half during the morning. We collect throw-away items from the parents and community which becomes the raw material for most of our art experiences.

One of the most comforting truths for any individual seeking ways to develop an educational system that fosters intellectual development, is that children over a wide age range can make use of the same materials in increasingly complex ways. Thus the problem of providing for varying age levels is solved by the children themselves in the way they make use of the materials.

[1] Hans G. Furth, *Piaget for Teachers.* (Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1970), p. 2.
[2] Ibid. P. 74.

The large and small blocks in our room are used enthusiastically by all the children. For some of the younger four year olds the challenge of keeping a simple tower of blocks from toppling in the process of building is enough. However, as they experiment and grow, new possibilities are disclosed out of their own developing understandings and needs. At the age of seven many of the children's constructions exhibit advanced understandings of structural and mathematical principles. One needs only to carefully examine the block buildings of the children to be convinced of the truth of your statement that parents and educators do not have to search frantically for ways to make intelligence grow because it grows from within. For the teacher or parent who understands such a viewpoint "the task becomes one of furthering and nourishing this growth by providing suitable opportunities, not by explicit teaching of what to do or what to know."[3]

In our opinion blocks are a very rich source of intellectual stimulation for any age child, but are especially well suited to the 5-10 age group, since, as you stated, it is during this age span that the child is developing concepts of space, time, relations, classes and combinations. In building or even in putting blocks away, the children cannot avoid making use of their intellect. In order to build a square house one must understand how to go about constructing sides of equal length. He must be able to choose combinations of different length blocks in such a manner that the two sides come out even. He certainly is experimenting with spatial relationships and he may even experience the unhappy truth that it is "time" to go home before he has completed his work.

In our classroom there are several sets of blocks. When we put things away at the end of the day the different sets are stored in different areas. All the unit blocks go together, the large hollow blocks are put in another place and the small geo-blocks are put in a box on a table. There are no strict rules about how the blocks are piled or put away, but frequently the children pile them in clearly discernable patterns, putting all the long ones together, placing the large cylinders in one space or stacking all the triangles together. It is obvious that even the "putting away" patterns of children become more complex and intricate with growth.

There are times when the children share discoveries they make in using the blocks. Just a few days ago while helping to clear the floor of the unit blocks, one of the youngsters laid two arches flat on the floor with the bases together. Then he demonstrated how the largest cylinder fit perfectly into the hole. Another time a child noted that two right triangles made a square and still another that the inclines could be placed together to form a perfect rectangularly shaped block. "However," he stated, "if you get the wrong sides together the ends won't come out even." Children make constant use of number and number combinations in block building activities. A child completing a building may be heard telling his partner to bring four half-size or two long blocks, or if none are available to bring eight quarters.

The rich intellectual stimulation which can be found in block building is also evident in other creative experiences. In letter 4 you suggested that most primary age children have not developed the concept of axial rotation. One of us had an experience with a five-year old, who was involved in a wood-working project, that illustrates your point beautifully. He was building a car and had found some bottle caps which he was trying to attach to the side of his vehicle with "U" shaped staples. Because he was experiencing some difficulty in piercing the metal caps with the staple, he asked for assistance in attaching the wheels. When it became obvious what he was trying, the teacher asked, "Do you want the wheels to turn?" He told her that he did, so she tried to show him that he needed a nail rather than a staple to make it work. The teacher took another piece of wood and attached the cap to it with the staples. When she showed how it would not turn and asked him why, he said, "The staple is too tight." She loosened it but he gave the same explanation. Finally, she took two long nails, drove them through the cap and into the board, but left the heads projecting at least an inch above the bottle cap. When the cap would not turn the child gave the same explanation for the failure, so she pulled out one nail and as he watched the cap rotate, he indicated that it was now loose. The teacher gave up and helped him fasten his wheels with single nails. The experience demonstrated, once again, that the most careful instruction has no power to bring about an understanding unless the learning organism is developed to the extent that it is able to respond. We are not concerned about that five-year old eventually reaching a clear understanding of axial rotation. It may be that he will grasp the concept at the work bench. For him and for us that seems to be a very appropriate and exciting place to learn it.

At the beginning of letter 10 you made the comment that you would "like to see less stress during the early grades on specific subject matter and more emphasis on the general development of the inquiring mind."[4] You went on to state that it should be enough that an activity is intellectually challenging for it to be welcomed in education. We were almost amazed at the statement since just a few weeks prior to reading your letters, we had written a similar idea in an attempt to clarify some assumptions underlying our program. The statement went something like this, "we assume that any subject matter which is meaningful to children is worthy of inclusion in the curriculum."

[3]Ibid, P. 74.

[4]Ibid, P. 116.

This is one of the reasons why we have many animals in our classroom, including a dearly loved baby lamb, a pair of bantam chickens, gerbils, rabbits and a hamster. The children have watched chicks hatch and grow to pullet size, have experienced the first-hand thrill of gathering a freshly laid egg still warm from the nest, have cradled, carried and fondled the rabbits from the time they were no larger than new born kittens. The children have personal knolwedge of birth, growth and change in their classroom pets and have even faced and dealt with the death of a few. The animals have served as a stimules for many questions. One day a youngster asked why the chickens had their eyes on the sides of their heads instead of in the front like we do. The teacher who was with him confessed that she could only guess at the answer, but that he would try to gather some studied data. When she came back with some facts about bird's eyes, explaining that probably some of the ideas would apply since the chicken was a relative of the bird, the discussion turned to the meaning of the word "relative", and finally to other interesting information in the same book that had been the source. There certainly seems no limit to the experiences and subject matter which will stimulate investigation and intellectual behavior on the part of children.

We concur with you on your view of drama as a thinking experience. In presenting a play there are indeed many problems to be solved. Again, it is exciting to note the increased sophistication with which the children approach the problems as they grow older. At a group circle time a few days ago one of our five-year olds was preparing to present a play. It was to be a superman production and he wanted to select his players from the circle. He asked for volunteers and got several responses. As he began explaining something of the action to his audience he asked two actors to step forward so he could demonstrate how superman knocks the villains heads together. A tiny four-year old and a seven-year old advanced. It was not until the five-year old director-actor placed his hands on the two heads that he understood his problem and asked for two children about the same size. This incident seemed to be a clear example of the direct manner in which the young child takes in and makes use of his experience. Of course, the problem of equal sized villians was only a beginning and you did a beautiful job describing the demands that play production places upon the intellect of the child.

As you discussed drama in letter 10, you pointed out the difference between spontaneous play and play acting -- play requiring no consideration on the part of the child to anyone outside himself. On the other hand, play acting demands a constant awareness of and attention to the audience -- a consciousness on the part of the actor that his purpose is to communicate an idea to the spectator. He must subordinate his actions to the plot, theme or idea. The problems are complex and numerous and, as you point out, demand a high degree of intelligent behavior. There is a subtle interaction between the child's understanding of the character being portrayed and the demand placed upon him to communicate clearly through his movements, expressions, and speech, that understanding.

We were impressed in letter 10, with the role the teacher played in stimulating the children to improve their acting skill. The teacher, whom you described, made ample use of audience reaction to help the players determine how clearly their ideas had come across. While we feel it is possible for an adult to encourage and support children in the process of perfecting their skills of dramatic communication it seems to us that there are some considerations for the teacher to keep in mind. If the teacher is focusing on the "Ideal or Good" play and not the thinking process of the child, he may encounter difficulties.

In our classroom, where play acting is a big part of the children's learning experience, the younger children, even in presenting a play for the group, may slip back and forth between play acting and spontaneous play. We feel, in these early stages of development, having an adult judge the performance on the basis of how well the ideas are communicated would do the youngsters a disservice. If Piaget's ideas of intellectual development are applied, one would not expect four or five year olds to be at a level where they have developed a clear distinction between symbolic play and play acting. From our observations it appears that these understandings are just beginning to develop at four and five. So, for the young child we would plead for a critic no more severe than spontaneous audience reaction and plenty of opportunity to watch the performance of older children. Anything more direct, we believe, might intimidate, discourage or reduce the entire activity to a non-thinking response to adult standards. We always run the risk, in incorporating any new activity into the curriculum, of treating it as a subject to be taught rather than as an experience which stimulates learning. We would not like to see this happen to drama or any other subject matter.

Sometimes parents ask us how we teach history or social studies in our class. We usually tell them that living, growing, learning and solving problems of personal and group interaction is the most stimulating way we can think of to learn "social studies". Perhaps, for young children, it is the only significant way. Therefore, it was exciting for us to hear you say, in letter 11, that education needs to train "individuals who are constantly encouraged to think and to apply this thinking . . . quite consciously to social and moral life, to the relation of man to his fellow men and his society and to relations among societies."[5]

[5]Ibid, P. 129.

The children in our classroom are constantly encountering social problems which require them to utilize their intelligence in finding a solution. Sometimes the problem may involve only two youngsters, but quite often it encompasses the entire group.

At the beginning of the year, the children decided they wanted to form groups which might go on field trips together or work on some long range projects. Their plan was to have a group for each teacher so we asked them how they thought the groups should be formed. One youngster said she felt all the children should tell the teachers some people they would like to be with and on the basis of that information, the groups should be formed and the teachers could then pick the group they wanted. We were pleased with this youngster's thinking and felt her solution was very reasonable. However, another child suggested that the three teachers draw names out of a hat and the group voted to use the second idea.

After a few weeks it became evident to the children that their plan was not adequate. Many of the youngsters were expressing a desire to change groups, so the matter was discussed again in the large group. They decided that those who wanted to change groups should go to a teacher and tell that teacher some other children with whom they would like to be grouped. For several weeks the children seemed happy with their decision, but recently the matter of grouping was brought up once again in the class meeting. New and closer friendships had been formed, and in some cases, best friends were in different groups. In other cases, children were feeling left out when some group chose to take a field trip that their own group had not decided to take. Still other children were expressing a desire to be with another teacher.

The problem seemed so complex that the children had to struggle for some time before making a decision. Realizing that everyone could not be satisfied they chose a solution designed to meet the needs of the greatest number of people. The groups would remain intact but each teacher would eventually have the chance to take each group on the trip originally planned by her own group. But, as one child so aptly expressed it, "That doesn't solve Christine's problem, because she wants to go when and where Jo goes."

We are continually pleased and often amazed at the skill with which the children approach problems that arise from the natural complexity of living together. There is certainly no need for teachers to "contrive" situations that demand the use of such skills. When children are free to interact, plan, work, experience conflict and cooperate together the dynamic relationships produce more material than one can handle!

Toward the end of letter 11 you said that if school is to be for real, the intellectual experience must be for real too. "This implies, particularly at the age level of early operational intelligence (ages six to nine) active intellectual exploration and evaluation of the social environment." [6] That is one goal we are striving very hard to reach. To us, it has been translated to mean direct experience of the community through class excursions but more important has been our emphasis upon helping the child in social situations to examine his own feelings and the feelings of others.

In our classroom, as in any real situation, there is conflict. Frequently, children may express their anger by striking out physically against one another. When we are doing our best job as teachers we sit down with the youngsters so that they will discuss the conflict and hopefully gain a clearer understanding of their own feelings and the nature of the problem. The discussions are frequently as heated as the physical battles and we, as teachers, try to do no more than get the feelings out and help the youngsters discover their own workable solution. There have been times when one child has taken the role of negotiator, arbitrator or therapist for other children in conflict. For us, this would be the ideal situation, but it is not always possible.

A strong advantage we have found in helping children to approach social or moral issues as problems to be solved rather than rules to be followed is that peer influence is far more effective than adult authority to encourage the individual to examine and modify his behavior.

Two boys from our classroom had spent most of an afternoon baking pies in the Home Economics Room. They brought them into the class just before final clean-up proudly displaying their finished products. While they helped the others put things away, they placed the pies on a table. Another child walked past and stuck his finger in each one, to sample it. As soon as the two bakers discovered what had happened they began to reprimand the other child severly and soon had several classmates supporting them in their campaign. By the time we finished clean-up and met for our final group circle all the children in the class were aware of the difficulty and were quickly becoming more involved in the conflict.

Our entire circle time was spent discussing the situation. Nearly every child had some opinion to express, emotions were running high, and it appeared that the two pie-bakers, Tom and Joe, were gathering increasing support. There seemed to be unanimity with in the group that the two youngsters had been wronged but when the discussion turned to ways of dealing with the problem there were several different suggestions. Some felt Bill, the youngster who had taken the sample, should miss snack on the following day. Others felt that he should be punished in

[6] Ibid, P. 137.

some way and Joe said that Bill should have to bake three pies for each one that had been "ruined". At this, one of the strong group leaders said, "Oh Joe, he didn't ruin your pie, there is only one little corner that he tasted and you can hardly see that he even touched it!" The entire group feeling shifted, as many of the children began to view the problem in a new perspective. Several said that they too had been tempted to touch the pies and recalled other experiences where temptation had been to great for them and they had snitched frosting or picked at a piece of cake. Tom and Joe became less indignant, were even able to listen to the discussion. Finally, someone suggested that the pies might have been put in a safer place and that any future baked goods could be stored in the office. Everyone agreed that the suggestion made sense. As the discussion concluded Joe looked down at his pie, dipped his forefinger into the filling and licked off his own sample.

A thinking school is not without problems, and conflicts and stress and struggle. However, it is a challenging and exciting place to be. Come and visit sometime and try out your mind on us.

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Remediating Arithmetic Via Teaching Logical Abilities

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The use of Piaget's theory in treating disturbed children is not a particularly new idea in this hemisphere. Dr. Jeannine Guindon, in the province of Quebec, has been utilizing a framework of Piaget and Erikson in her rehabilitative effort for the past twenty five years. She now has five or six centers, each one accepting a different age and sex of children or adolescents, and manned by "psycho-educateurs." The latter staff people are psychology majors who, after graduating, must take one year's internship in one of her centers. The result is, of course, a staff of people, highly trained both in education and abnormal psychology, who work with the children directly with no intervention by any other discipline. They are the teachers, they are the counselors, they are the child care workers. That is to say, it is the *psycho-educateur* who is with the disturbed child twenty-four hours a day. The results and rate of recidivism reflect the success of this approach. Other successful work is being done using Piagetian theory with brain damaged and learning disabled children at St. Justin's Hospital and McGill University in Montreal.

We are all familiar with the influx of Piagetian influence into early childhood education. The hopsital of which I am Director of Psychology - Sagamore Hills Children's Psychiatric Hospital in Northfield, Ohio - came to be interested in Piaget's ideas from a slightly different orientation. We had been using Dr. Sam Kirk's diagnostic test, the ITPA, and designing remediation on the basis of its findings with very good results. We were so enthusiastic about this method of assisting our learning-disabled children that we wondered about our children who were having extreme difficulties with arithmetic. We hypothesized that they might have an underlying logical difficulty which might prevent them from understanding and utilizing the arithmetic information taught to them. In the early part of 1972 we were granted some title funds to implement a program which was more a research and demonstration project than strictly educational. Our early efforts went toward developing Piaget tasks of logic assessment for the children and of working out ways of remediation in the areas in which they showed weaknesses. Just as we found that our learning disabled children having trouble in language arts improved greatly in ability to read, spell, and so forth when we worked with their basic disabilities, we have also found that our children in the arithmetic project made gains in arithmetic when we worked with their basic logical disabilities.

A primary objective of the project was to give our children the logical concepts needed for understanding arithmetic fundamentals. Piaget's theory of cognitive development holds that children develop concepts only by operating on or manipulating their environment. Identity, reversibility, and conservation and other cognitive functions develop out of the sensori-motor experiences and learning of the child. A concept of number (which is not the same as the ability to count) develops only after the child has learned to classify or categorize objects and also to seriate or sequence them (i.e., arrange them in order according to some specified characteristic). It is therefore necessary for children to experience these operations at the sensori-motor level in order to reach an understanding suitable to their ages. They must be exposed to experiences underlying the cognitive functions which precede and are basic to the concept of number. This is particularly true of learning-disabled children, many of whom have difficulty with sequencing and abstracting in all areas.

Our project classroom is set up for very small classes - one, two, or three children at a time. A large quantity of equipment is available to the children allowing them to experiment and manipulate in many areas such as sorting, serializing, pouring water, and so forth. Many games suitable to the fostering of logical concepts are used. Because of the many negative feelings about arithmetic which the children bring with them, we also arranged a token reinforcement system for motivational purposes. The teaching of actual arithmetic skills is begun only after the student has demonstrated he has a grasp of the basic logical concepts.

Children are referred to our project from their usual arithmetic class and are evaluated by means of standard achievement tests to find out just where they stand academically. If they are two years or more behind in arithmetic achievement they become eligible for the project, providing they are (1) over the age of eight, and (2) not basically intellectually retarded. The children declared eligible are then further evaluated with a "copying" test to assess their ability to copy and manipulate figures physically in space, and administered the series of Piagetian tasks developed for the project. Their scores are recorded in all of these tests and remediation is begun.

In all cases of poor academic arithmetic achievement, we have found basic logical difficulties in our children. In many cases, we have noted ten and eleven year old children unable to deal with Piaget tasks usually solved by normal six and seven year olds. Some of the children seemed to be more deficient than others and required much repetition of the remedial lessons before they could permenently acquire the concepts needed. We used different materials to teach the same concept as often as possible for two reasons - (1) to

encourage generalization, and (2) to prevent the students' becoming dependent on either materials or particular situations.

We also noted frequent overlapping of disabilities with the result that many project children were also dyslexic to some degree. This finding did not surprise us, since sequencing is basic to both language arts and arithmetic, and spatial difficulties interfere with handwriting as well as copying problems. We had anticipated that remediation of some of these abilities in the special arithmetic class would carry over into language arts classes, as in fact they have.

What did surprise us came from a step-by-step analysis of the tasks of classification and seriation. We observed that our more deficient children had a basic difficulty which struck us as quite primitive - an inability to keep two things in mind simultaneously. For instance, the process of classification involves both intension and extension, intension being the properties common to the members, and extension defining the members of a given class. What this means is that the child must coordinate intension and extension to develop true classification. To determine what properties are common to a set of elements, the members of the set cannot be examined one at a time, but must be looked at altogether. At the same time, while looking at them, the intensive attributes or reference to common properties must be kept in mind. As Piaget says . . . "Extension presupposes intension, and vice-versa" . . . (THE EARLY GROWTH OF LOGIC IN THE CHILD, p. 248). What our children failed to do many times was to remember to do both at the same time. If they remembered what they were looking for, they did not remember to look at all the members of the collection in front of them, or, if they remembered to look at all the members in front of them, they forgot what property they were looking for.

This particular kind of memory, being able to remember more than one thing at a time, appeared as a deficiency in most of our project children on one task or another. In checking farther, we found behavior in other situations which reflected the same difficulty.

Many of the greatly disabled children had difficulty with cause-effect relationships and would repeat inappropriate behavior on the ward or in the halls again and again without seeming to learn from experience. We hypothesized that while the child is caught up in the experience and totally involved in destructive activities, fighting, racing, yelling or whatever, he is *unable to remember at the same time* the consequences of such activities. Since he never makes the connection until afterwards when he is experiencing the consequences, he is unable to inhibit the undesirable behavior while it is happening. He does not foresee consequences because he cannot remember their existence at the same time that he is caught up in his exciting behavior. This hypothesis suggests a number of lines of possible research.

The project is not yet a year old at the time of this writing; however our results have been very good to this date. Six children, having gone through the project so far, averaged a 3 1 grade level on the CAT before remediation and a 4.2 grade level after remediation, a gain of over a year. Individual gains were in some cases as high as one and one-half grade levels within three to four months. Post-testing with the Piaget tasks also showed many gains although in some instances an individual child did not master all of the concepts involved.

In conclusion, we feel we have demonstrated the worth of this approach with children who are dyscalculic. We are hoping to go further in the research, particularly into the question of which logical concepts are related to arithmetical processes in the practical hope of lessening the testing time. It takes five to six hours to administer twenty-eight Piaget tasks to the children at this time. However, we do not feel we can eliminate any of them until we know which are the essential ones. A better understanding of the relationship between logic and mathematics will also result in better remediation techniques.

We have recently become very interested in the work of Dienes at the Centre De Recherches en Psycho-Mathematique at the University of Sherbrooke. Professor Dienes is evolving ways of bringing logic into the learning of not only mathematics but language arts as well, from the kindergarten level on up. His planned series will become available from the Montreal publishers – Editions HMH, 380 Craig Street. W., Montreal 126, Quebec, Canada – within the next year. However, these lessons have been designed for French-speaking children and will need to be translated for use in this country, a task which Professor Dienes does not anticipate in the near future.

The materials Dienes has created are enchanting as well as practical, and children especially find them so. In his careful, step-by-step approach, the child is encouraged to stay with concrete materials as long as necessary before actually "doing" arithmetic on paper. The result of this teaching method is not only happier children, motivated to learn arithmetic, but whole classes of fifth graders able to multiply and divide three digit numbers in *any* base as well as ten.

Because of the Dienes' emphasis on the concrete materials, we are beginning to incorporate some of them into our own remedial and primary classes. We find learning disabled children responding with enthusiasm, and even better than that, learning readily the concepts they find so difficult to master.

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The Modification of Age-Specific Expectations of Piaget's Theory of Development of Intentionality in Moral Judgments of Four-to Seven-Year Old Children in Relation to Use of Puppets in a Social (Imitative) Learning Paradigm

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OBJECTIVES

The underlying purpose of this investigation was to ascertain whether the age-specific expectations of Piaget's theory (1965) regarding the development of moral judgment in children from four to seven years of age -- a theory which has been challenged by recent research studies (e.g., Bandura and McDonald, 1963; Bandura, 1969) -- were modifiable through use of a certain adaptation of Bandura and McDonald's imitative learning paradigm which had utilized adult models. In this study of pro-social learning of pre-school and first-grade children, an adaptation of the social learning paradigm involved the introduction of a 20-minute film (1) using glove-type, hand-manipulated puppets as models to act out Piaget-type stories, which provided a natural plot or dramatization and (2) affording vicarious reinforcement (Bandura, 1965) from a six-year old peer throughout the treatment in an effort to maximize the resultant acquisition of those moral judgments that involve the distinction between social acts of intentionality or accident.

Questions to be Answered. In terms of both immediate and delayed generalizability of four- to seven-year old children's moral judgments, the objectives of the investigation were clarified in terms of the following questions:

1. Was there an age difference in the objectivity (focusing on immediate consequences of an accident irrespective of intent of the subject -- an immature reaction) vs. subjectivity (intentionality or a purposeful act reflecting a mature moral choice) continuum of intentionality choices between children aged four to five years and six to seven years?
2. How effective would the treatment (a color and sound 16mm. film-mediated performance of a puppet which imitates the actions of the characters in Piaget-type stories of accidental-intentional themes and receives vicarious reinforcement from a six-year-old peer) be in producing change from objective to subjective judgments?
3. Would there be an interaction between treatment effects and age level?

METHOD AND TECHNIQUE

Subjects. The sample used in this study was composed of 80 children enrolled in six public and private schools (nursery, kindergarten, and grade one classes), located in the area of Redlands - San Bernardino, California. The subjects whose ages ranged from four- to seven-years came from homes covering all levels of middle class socio-economic status.

Instruments. Piaget-type stories, adapted by Crowley (1967, 1968) into picture-story booklets, were used in the four phases (pretesting, treatment with a film relating 10 sets of two stories reflecting intentional or accidental behavior, immediate posttest, and two-week delayed posttest) of the experiment. The stores included some previously used by Piaget (1965) and Bandura and McDonald (1963), but were rephrased and simplified by Crowley, in order to be more intelligible to first grade children.

Experimental Design and Statistical Analysis. A pre- and posttest 2 X 2 factorial experimental design (treatment vs. control and four-to-five vs. six-to-seven year age level) involving random assignment of 10 subjects to each of four classifications was employed. As dependent variables, immediate posttests and delayed posttests were separately analyzed for statistical significance by two-way analysis of covariance with age and treatment as the main variables, and with pretest scores as covariates. Both planned and post hoc comparisons among individual pairs of means were made. The program used was the BMDX64 -- General Linear Hypothesis -- prepared by Dixon (1969).

FINDINGS

Pretest results showed that there were no significant differences between the subjects across all age categories from four- to seven-years. Therefore, all subjects started this experiment on an approximately equal basis.

The variable of age, for both the immediate and two-week delayed posttest, yielded no significant differences in average performance. The treatment variable exhibited differences in mean performance of the immediate posttest and the two-week delayed posttest which were significant, respectively, at the .01 and .05 levels. Following elimination of all questionable responses (a judgment made by 89 assistant examiners regarding the subject's genuine understanding of the story requirements of intention or lack of it) the treatment variable showed differences in mean performance of the immediate posttest as significant at the .001 level and the two-week delayed posttest at the .05 level of significance. There was no significant interaction effect associated with treatment and age in this experiment.

CONCLUSIONS

The results of this investigation were similar to other empirical studies (e.g., Bandura and McDonald, 1963; Crowley, 1968; Glassco, Milgram and Youniss, 1970; Jensen and Larm, 1970) in the moral domain. However, none of the other experiments was so limited in treatment time (twenty-minute film), nor did they include such a low age range in their studies.

Within the limited context of this investigation involving the distinction between social acts of intentionality or accident, it would appear that the use of the film was a vehicle for promoting moral development and that the posttest results afforded a basis for questioning the age-specific expectations of Piaget's theory.

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A Commentary On An Unusual Dialogue Between Jean Piaget and Lev S. Vygotsky

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In short, modern psychologists and educators owe a great deal to Jean Piaget and Lev Vygotsky. It is not an exaggeration to say that they revolutionalized the study of language and thought. They developed clinical methods of exploring children's ideas which have since been widely used by a host of professionals. The Swiss and Russian psychologist were among the first to investigate child perception and logic systematically. Moreover, they brought to their subject a bold approach. Instead of listing the deficiencies of child reasoning compared with that of adults, both researchers concentrated on the distinctive characteristics of child thought, on what the child has rather than on what the child lacks. Through their efforts to free the child from such adult domination, Vygotsky and Piaget discovered for all men the means whereby they can use their symbolic conceptions of reality to mediate between their inner world and the outer one. More importantly, the Russian and Swiss psychologists freed all men from rigidity of stimulus-response theory.

This study is an attempt to describe and analyze the substance of an unusual dialogue between these two brilliant psychologists. In addition to the description and analysis, some of the practical implications of their theoretical discussions were pointed out for parents, teachers, and other professionals who are concerned with the development of children. From the description and analysis, there emerged a number of key conceptions which merited more detailed investigation by American educators. Among these viewpoints of Piaget and Vygotsky, the following views seemed particularly important:

1) The importance of cooperation and its facilitation of decentering,
2) Concept formation and its dependence upon the overall mental development of the child,
3) The two types of conceptions (scientific and spontaneous) and their roles in the processes of instruction,
4) The negative consequences of improper intervention and the importance of building upon spontaneous conceptions.

Briefly then, the study indicated where the theoretical views of Piaget and Vygotsky crossed paths yesterday, and suggested some of the implications from these converging views.

Abstract
Logical Abilities of Young Children – Two Styles of Approach

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Over the past few years there has been considerable research activity among Americans (but also extending to the Japanese and British) on the general topic of children's logical abilities. (See Roberge, 1972, for a partial listing of the American studies). Each of these studies has attempted to use variously designed objective tests as measuring devices to determine the abilities of young children to respond in accordance to the principles of formal logic and set theory.

Several exemplary test items, each representing a different logical reasoning pattern (modus ponens is the first), are analyzed utilizing two of Piaget's cognitive structures: Transductive logic and Grouping I. The analyses show that much of the reported performance of young children from these studies should have been expected and can be explained on the basis of Piaget's theory.

Although results of these analyses are contrary to widely held interpretations of Piaget's views concerning the logical abilities of young children, they nevertheless show the mutual support which can exist between Piaget's work and that of the Americans. Specifically, the American data provides independent verification of Piaget's findings while Piaget's work provides theoretical interpretation for the mass of data compiled by the Americans.

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Do Preschoolers Learning to Sort Prefer the Help of Vygotsky or Piaget?

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In his paper presented to the 3rd Annual Piaget Conference entitled "A Commentary Upon an Unusual Dialogue, etc." Dr. Zender has clarified areas of agreement and disagreement between Vygotsky and Piaget. With respect to the primacy of action in a context of adaptation, both theories agree with each other and I agree with Dr. Zender. However, with respect to the importance or weight each gives to language in development of concepts, I will have to disagree with Dr. Zender on the extent to which Vygotsky and Piaget agree. Vygotsky, it seems to me, places more weight on the importance of language.

I shall attempt to clarify this difference which emerges in their consideration of classification and then describe an experiment based on that difference and what was learned from it.

The area of making classifications has traditionally been a favorite research area for observation and theorizing about the role of language in thought. Because in order to group several items together, one must:

a. have a criterion by which to group, and
b. be able to hold that criterion in mind while making comparisons for the purpose of deciding whether an item belongs or doesn't.

The question asked in the present study is "does language provided for the child in discriminating specific criteria help him significantly to learn to create and hold criteria for grouping?"

In general it is agreed that the younger the child the more unstable and shifting a criterion will be and the more perceptually dominated. We call this *unstable* and *concrete* or associative sorting as opposed to stable and truly inferential or abstract. The more abstract the sorting, the more the person must rely on his own internally stored representations.

The following figure shows the striking similarity of the two frameworks that Piaget and Vygotsky independently arrived at to describe stages in development of classification ability. I have placed them side by side so that you may see where they almost duplicate each other in developmental progression.

(See Figure 1 on next page)

The study which I will describe to you attempts to move 3-5 year old children on this continuum toward more consistent and inferential criteria from Piaget's Stage I into II_2 or from Vygotsky's State II A -D to E -F.

While this similarity of their respective schematization appears striking it should be recognized as representing a surface similarity. For Piaget places relatively little importance on language for the development of seriation and classification. He states that these are largely independent of language. The following quotation makes this quite clear.

> In other words we accepted from the outset that it is not enough to study the ways in which *intension* and *extension*[1] are as it were prefigured for the child *in the system of verbal concepts which incorporated in common language.* As a matter of fact, the results of our investigations on "all" and "some" . . . showed clearly that children only reach a proper understanding of the extension of verbal concepts (and also for that matter perceptual configurations) in the measure that they themselves can restructure the content. In other words, the *starting point for the understanding, even of verbal concepts is still the actions and operations of the subject.* (Inhelder & Piaget, 1964, pp. 283).

Vygotsky on the other hand gives language an important role in the *formation* not just the final naming of a concept. In discussing the child's movement from dim unstable concepts to pseudo concepts and beyond he says the following:

> (These) pseudo-concepts predominate over all other complexes in the preschool child's thinking for the simple reason that in real life complexes corresponding to word meanings are not spontaneously developed by the child: *the lines along which a complex develops are predetermined by the meaning a given word already has in the language of adults.* The child's own activity in forming generalizations is by no means quenched, though it is usually hidden from view and driven into complicated channels by the influences of adult speech . . . verbal intercourse with adults thus becomes a powerful factor in the development of the child's concepts. The transition from thinking in complexes to thinking in concepts passes unnoticed by the child because his pseudo-concepts already coincide with those of the adult. Thus the child begins to operate with concepts, to practice conceptual thinking before he is clearly aware of the nature of these operations. (Vygotsky, 1962, pp. 62-81.)

So we see that while the structure of Piaget and Vygotsky's frameworks is essentially similar and while they both give

Figure 1

A Comparison of Piaget's and Vygotsky's
Developmental Phases of Classification

Piaget

Stage I: Pre-Classificatory

1. Graphic Collections, Aggregates Based On
   - A. Alignments
   - B. Collective Objects
   - C. Collective Objects

Stage II: Quasi-Classificatory

1. Non-graphic Collections Based on Similarity Alone
2. Mechanisms of Above: Retroaction, Foresight

Stage III:

1. Class Inclusion and Hierarchial Classification

Vygotsky

Stage I: Syncretic

1. Unorganized Congeries
   - A. Trial and Error, Random
   - B. Contiguity: Space and Time
   - C. Elements Combined from Previous Groups

Stage II:

1. Complexes
   - A. Associative, Based on Similarity, Proximity
   - B. Collection
   - C. Chain
   - D. Diffuse
   - E. Potential Concept
   - F. Pseudo Concept

Stage III:

1. True Concepts

Table 1

Breakdown of Cases in Each Treatment as Seen in Pretest Scores for Whole Sample (123)

	T_1 Verbal			T_2 Non-Verbal			T_3 Control		
	Co[1]	Fo[2]	Fu[3]	Co	Fo	Fu	Co	Fo	Fu
A – Total Ss Pretested	41	41	41	41	41	41	41	41	41
Ss Scoring 16-18: Too High Passers	30	19	0	28	21	0	27	20	0
B – Ss Remaining (Subjects who participated in experiment)	11	20	41	13	20	41	16	21	41

1 Color
2 Form
3 Function

recognition to action and activity of the child, there still remains a key difference with respect to the weight given to language and especially of adult language in the role of the child's concept formation.

For Vygotsky says, "The decisive role in this process (movement from potential is true concepts) as our experiments have shown is *played by the word* deliberately used to direct all the part processes of advanced concepts formation." (Vygotsky, 1962). And the word we presume is supplied by the adult in interaction with the child.

A. Luria (1959, Vygotsky's brilliant student further explains the power of the adults words:

> By naming objects and so defining their relations and connections the adult creates new forms of reflective reality in the child incomparably more complex and deeper than those which he could have formed through individual experience."

Do adult words really have that much power or is the child's own action the decisive factor?

The following study was conceived in an attempt to deal more precisely with this problem.

Specifically the following three questions constitute the heart of the study:

1. Can 3 - 5 year old black ghetto children be moved further along on the continuum of sorting ability to sort in two short but intensive training periods?
2. Which is the more effective teaching method: T_1) The verbal method in which the child is given practice in sorting with verbal rules and labels supplied by the adult or T_2) the nonverbal symbolic gestural method where the child either simply imitates adult actions or pantomimes his own.
3. The third questions asks whether two different approaches are differentially effective depending on the level of difficulty of the task, defined in this study as sorting by *color* (easiest), *form* (next difficult) and *function* (most difficult because most abstract.)

Two subsidiary questions ask whether there are any age or sex differences in performance in general and whether there are any age by treatment interaction or sex by treatment interactions.

Design and Procedure

The overall design used to test above hypotheses was analysis of variance of the difference scores in a 2 x 2 x 3 factorial design. This was followed up by specific means comparison test for further analysis. Independent variables are age, sex and type of experimental training and the dependent variables are the difference scores obtained from pre-post comparisons on the K variables of sorting by color, form and function.

Subjects

Children were taken from six children's centers in the Watts section of Los Angeles. They were all Black. In all there were 123 subjects who were randomly assigned to treatment and control groups so that there were 60 males and 60 females subdivided into two age groups, three year olds and four year olds. Within each age grouping there were 10 males and 10 females in each of the two training groups plus a control group. The arrangements of the groups is shown in Figure 2.

Each child was taken out of the classroom to a nearby office to be worked with individually and told that he would be shown some little toys and play some games. The following procedure was used throughout. The children assigned to training of either type were seen as follows:

FIGURE 2

OVERALL DESIGN:
Experimental and Control Groups

		MALES		FEMALES	
		Three Year-olds	Four Year-olds	Three Year-olds	Four Year-olds
T_1	(Verbal)	10	10	10	10
T_2	(Nonverbal)	10	10	10	10
T_3	(Control)	10	10	10	10

Day One	1. Warm-up and pretest	10 minutes
Session One	2. Training: First Session	20 minutes
Day Two	3. Training: Second Session Refresher	10 minutes
Session Two	4. Posttest	10 minutes

The control children were seen twice also, however, there was no training period or refresher session for them, so that they were seen for approximately 20 minutes, ten on each day. Pretest and training were done on Day One for the Experimental groups and refresher and posttest on Day Two. The same procedure of two successive days was used with the controls.

Procedure for Each Session

Pretests Warm-up

Pretest: "Same"	To determine if child understands meaning of "same".
Experimenter (E):	Do you know what I have here (shows money in plastic bag and sets out on table)?
Subject (S)	Money. (If no money, E says, "Money, right?")
E:	Can you show me any of these that are the same? (If child points to one only, then E says: "Find the other one that's the same as that.") Now watch me very carefully. See what I'm going to do. (E pushes out penny from random group and groups other pennies with it, then dimes and quarters.) See what I'm doing? I'm putting all the same ones together. Now I'm going to mix them all up (mixes them) like this and now, can you put all the ones that go together in the same place the way I did? Try it.

If the child has difficulty, E provides sample for the child to match and helps him until all 12 are sorted.

Pretest: Color

Objects: Buttons, four each, black, blue and yellow, 1¼" in diameter.

E:	Now we'll play a game. You close your eyes while I put something out on the table. Put your hands over your eyes and don't peek. (E puts out buttons.) Good. You're very good, you don't peek. Now when I tell you to open your eyes, you put all the ones you see that go together in the same place. OK? Open your eyes.

After the child has sorted the buttons, E asks him to help put buttons back in bag.

Pretest: Form

Objects: Cookie cutters, four each, rings, crescents and camels.

E: The E uses the same procedure as in the pretest for color. "Close your eyes" game.

Pretest: Function

Objects: Blue piano, green car, yellow and red boat, red and yellow tractor, corn flakes (individual box, Kool-Aid packet, Mortons salt (individual miniature), cracker and cheese (5¢ packet), change purse, wallet, quarter, and and glass piggy bank.

E: The E follows the same procedure as above.

If the child plays more than two minutes with the objects without attempting to sort, E asks, in relation to what he is holding and playing with, in an attempt to get a sort started, "What can you put that with?"

Training: Session One

If a child has not passed form, color, or function by making a near perfect exhaustive sort, he is trained on whichever or all of those failed.

Training: Color

Objects: Marbles

T_1: Verbal

E: Now, I'm going to show you some marbles and we're going to put the ones that are the same color together. (E sets out large box of marbles and three small boxes that divide in two so that all six colors have a separate space.) Look, here's a red one and here's a yellow, let's put all the one's that are yellow here, etc. Do you know what these are and so on? (If the child errs E asks, "Is that the same color? See, this is black and that is green, etc.")

T_2: Non-Verbal

E: Now we're going to play a game called "You do what I do." See what I'm doing? (E puts reds in same box, then sets out one sample in each of the other compartments.) Now you do it. (If child errs, E merely points to correct box without explanation.)

The Ss continue sorting until all the marbles are exhausted and the E says to both T_1 and T_2, "Very good. Now let's put them all back."

Training: Color and Form (Combined)

Objects: Barrettes, each form has a distinctive color.

T_1: Verbal

E: Now let's put all those that are exactly the same together. (If child errs, E says, "Look. These are not the same. Can you tell me why?") (If child cannot say, E says, "See, this is longer, it has no hole in the middle, etc.")

T_2: Non-Verbal

E: Now you "Do what I do." E takes a barrette out to one side and nods to child to go ahead. E continues modeling only until child begins to match, to his own sample.) (If child errs, E points to difference, non-verbally.)

Training: Form

Objects: Metallic objects which are all one color consisting of thimbles, screws, and jingle-bells

E: The E uses the same procedure as in the training session for color and form.

Training: Function

Objects: The pretest-function objects are used for the training session. They include blue plane, green car, yellow and red boat, red and yellow tractor, corn flakes (individual box) Kool Aid packet, Morton's salt (individual miniature) cracker and cheese (5¢ packet), change purse, wallet, quarter and glass piggy bank.

T_1: Verbal

E: After the objects are set out, E says "Now what do we do with this (picks up corn flakes box)? Good, we eat it. Now can you find any other things here that belong with this that we can eat? Now these may not look exactly the same but why are they the same? Right, because we can eat them, so let's put all these eating things over here. What else can you find that goes together, etc."

T_2: Non-Verbal

E: Picks up corn flakes and pretends to eat from it with an imaginary spoon. Then hands box to child and nods for him to imitate and points to a place out from the whole group of objects for him to put it. So forth with each object. The eating things are all "eaten" (example: salt shaken and licked off palm, Kool-Aid sipped, etc.) the riding things each get a characteristic ride (airplane in sky, etc.), and the money things get handled typically. Quarter is put in bank and shook out, then put in purse. Toy money in wallet is taken out, looked at and put back in. After the action with the object, it is put into its own separate group of four things. At no time does E explain why they are put together, etc.

Training: Session Two

Session two is a refresher session. The barrettes are used in refresher training of the color and form sorting tasks.

Training: Function

Objects: Miniature flashlight, small bulb, book matches, birthday candle, frying pan, egg beater, measuring spoon, comb, toothbrush, soap, and mirror in comb case.

T_1: Verbal

E: Same general procedure as previous function training session

What do you do with this?

S: Comb your hair.

E: Yes, you make yourself look nice. Can you find other things to help you look nice? (After all things have been sorted, E asks child to close eyes and E puts object (frying pan) in grooming pile.)

Now open your eyes. Do you see something that's in the wrong pile? (E tries to elicit rule.) That's right, don't comb your hair with a frying pan, etc.

T_2: Non-Verbal

E: Same as before. E allows child to handle and play with objects freely and sees if child starts to sort by himself. If not, he starts off by pretending to comb hair and places comb to one side. He models only until child begins to do it himself, or when child needs help in inventing an action for the object.

Posttest:

Posttest: Color

Objects: Buttons, four each, marroon, ivory and black colors

E: Puts out in random order and asks the S to put the ones that are the same together.

Posttest: Form

Objects: Cookie cutters, four each, shamrocks, diamonds and heart shapes

E: Puts out in random order and asks the S to put the ones that are the same together.

Posttest: Function

Objects: Dress, pants, shoes, purse, coffee pot, cup, baking pan, plastic fork, small spiral pad, pencil, crayon, chalk in box.

E: Sets out in random order and says, "Put all the things that are the same in some way, that belong together, in the same place."

All pre and posttest sorting arrays contain 12 objects. These 12 objects can be exhaustively sorted into three complete categories of four objects in each. The following is the scoring system:

1 Pair	1 Point:
2 Pair	2 Points:
3 Together	3 Points:
4 Together	4 Points:

The above scoring system was based on the number of pairs possible in each grouping, as a way of reflecting the relative strength of more objects correctly placed together in an exhaustive sorting of a category. A perfect score on the variables of color, form and function would be 18 for each respectively, and 54 for the total of all three.

If three objects are grouped together but only two of them are correct, then credit is given only for the pair. No attempt at penalizing for wrong addition is made. In other words only correct responses are scored.

Table 2

Means, SDs, and F Statistics Between Groups Aged Three and Four on Color, Form, and Function on Pretest Scores for Total Sample

	Three Year-Olds (N=62)		Four Year-Olds (N=61)		
	$\bar{x}$	SD	$\bar{x}$	SD	F
Color	10.887	8.185	15.508	5.726	13.123**
Form	9.758	6.510	14.148	6.390	14.235**
Function	1.113	1.775	1.738	2.065	3.240

$F_{1,\ 121}$ = 3.92 at $p < .05$*
= 6.85 at $p < .01$**

Table 3

Specific Comparison Tests on the Difference Score Means for the Three Treatments

	Color N=40		Form N=61		Function N=123	
Treatments	F	Sig.	F	Sig.	F	Sig.
T_1 vs T_2†	1.492	n.s.	.606	n.s.	7.168	**
T_1 vs T_3	39.368	**	19.787	**	54.108	**
T_2 vs T_3	27.471	**	13.398	**	21.889	**

** $p < .01$

† Means for T_1 vs T_2 on Color: 12.091 vs 9.769
Form: 10.050 vs 8.700
Function: 6.171 vs 3.854

Results:

Results were obtained for the following number Ss that may be seen in each category that qualified for the study by having failed to pretest.

Table 1: Shows that at pretest roughly 2/3 could sort by color, roughly 1/2 could sort by form and none could sort by function.

This left for experimental training roughly 1/3 to be trained for color, 1/2 for form and all for function.

This appears to confirm the notion that more complex scanning and comparisons must be made to group by form than by color.

There was as can be seen in Table 2, a significant age difference in competence between 3 and 4 year olds at the start of the study on pre-test analysis.

In the next Table Three, we find answers to the central questions of the study. Significant differences obtained show that both training even brief as they were in this study to have a significant effect as compared with the controls who had no training. We see that this is not true for color and form. Either type was as effective as the other. However, with respect to the more inferential sorting required by the function task the verbal treatment was significant. A more refined analysis of this result shows a very interesting Sex by Treatment interaction.

It may be seen that when total difference scores are analyzed, there is a significant difference favoring higher level of performance on nonverbal training for boys as compared to girls. On function scores alone the compliment of this may be seen with a significant difference between the girls higher level performance in Verbal as compared to Boys in Verbal treatment. A comparison between girls in Verbal and girls in Non-Verbal is also significant, showing girls differ greatly in their ability to utilize the two interventions. Boys on the other hand show no such marked preference for either treatment.

With respect to age, there was no significant difference between 3 and 4 year olds as a result of their training. This is the initial significant difference on pre-test between 3 and 4 year olds performance was wiped out by the treatment.

Conclusions and Discussion

While making no claims for the durability of the results obtained, the results of this study do support specific kinds of environmental encounter or structuring on the part of the adult as facilitating the ability to classify.

A second finding of this study is that in general the results favor the importance of language in fostering the more inferential or abstract sorting abilities. We might say then that the Piaget position which maintains that "active construction" is most important for the derivation of classes is

Table 4

Analysis of Variance Means of Total* Difference Scores for Sex by Treatment (color, form and function)

			f	
	X Males	X Females	Males vs. Females	p
T_1	12.80	15.80	1.03	n.s.
T_2	15.30	7.08	10.03	.01
T_3	1.25	1.95		n.s.

*scores for color, form and function taken together

Table 5

Sex by Treatment Interaction Means for Function

			f	
	X Males	X Females	Males vs. Females	p
T_1	5.08	7.35	3.46	.05
T_2	4.90	2.88	2.70	n.s.
T_3	-.28	.30		n.s.

df = $F_{2, 111}$ 3.08 at $p < .05$
4.80 at $p < .01$

a position which holds for the more concrete or visible categories. However, where the categories required become more abstract, the superiority of the verbal method is shown in the present data.

It must be remembered, however, that the verbal method in this study was not entirely devoid of operations or active constructions. Children were engaged in handling materials but had what appears to be the advantage of verbal rules and attribute labels with which to organize their activities. The importance of language becomes apparent when one contrasts the results of verbal and non-verbal training along the levels of abstraction, for the lower levels of color and form where sorting criteria were highly visible, both types of training were equally effective.

Language was not necessary, perhaps superfluous at the lower levels of classification but when the difficult level of function was attempted, language while not sufficient in itself certainly became more necessary but especially for females. The finding of sex of treatment interaction in this study has intriguing implications for differential curricula. One is tempted to ask: Is learning by discovery different for boys and girls; can girls discover more in discussion than boys and do boys because they are less able to utilize verbal discussion need more activity channels by which to integrate knowledge?

Some of the incidental findings of this study validate both Piaget and Vygotsky's conception of the child as active enquirer. Over and over again 3 and 4 year olds would ask questions in regard to the items "Who spoon?" "Who dress?" "dis my pencil?" "dis you pants?" "where's da girl?" (handling clothes) "where da mommy?" "Somebody lost these?" Their preoccupation with associating these objects to contexts, people with whom they would make sense were continual evidence of their need to integrate their world.

Occasionally a child asked a question and answered himself "Where da girl" followed by "She at school."

It should further be noted that there was extreme readiness and interest of children to enter into a learning situation which left room for their imaginary symbolic play and developmentally appropriate egocentricity. For example, Darren R. picks up each item ignoring request for sorting and says:

"I make some coffee."
"I'm coloring."
"I'm a eat."
"I'm a cooking cookies."
"I'm a puttin my shirt."

When asked in the posttest "What could that go with?", for the dress, Stacey K. answered "on me." Other children literally tried to put the miniature purse handle over their wrists, or went through motions of putting trousers on.

Spontaneous recall and comparison occurred often and are evidence of the unsolicited child's own effort at integrating experience "I saw one of these at Sears." (boats) And the child who upon seeing the crescent-shaped cookie cutters said "That's a moon and that's a moon" was evidencing the kind of recall and association ability that black ghetto three to five year olds are presumed by some to have little of.

The results of a study on classification cannot be seen apart from the materials the children are asked to classify. It is an obvious but often overlooked cliche in pre-school that materials that have high interest value for the student are vehicles for a further academic ride. It is doubtful that results obtained in this study could have been obtained with pictures or items of less interest to children. Vygotsky warned about making the school for young children a copy of the school for older children. It would appear that choice of appropriate materials is one way to avoid that.

So finally in answer to the question: "Do 3 - 5 year old preschoolers learning to sort prefer the help of Piaget or Vygotsky, we must answer: On color and form they can be helped by either. But on more abstract function, if they are girls they vastly prefer Vygotsky. If they are boys, they can use the help of either just as well.

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Cognitive Growth in Young Children: Some Theoretical Implications Pertaining to identity, Language and Memory

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The study of the developmental process within a Piagetian framework presupposes an understanding of the term "development" which is intimately linked to the very nature of the process itself. Comparing development with learning, for example, Piaget takes pains to underscore the uniqueness of its action within the total epistemological context, emphasizing the child's ability to "elaborate a more and more adequate knowledge of reality. It is precisely the successive forms of his activity in the course of his development that determines his modes of knowledge (Furth, 1969)." "The development of knowledge," says Piaget (Voyat, 1971), "is a spontaneous process, tied to the whole process of embryogenesis. Embryogenesis concerns the development of the body, but it concerns as well the development of the nervous system and the development of mental functions; in the case of the development of knowledge in children, embryogenesis ends only in adulthood. It is a total developmental process, which we must restitute in its general biological context. In other words, development is a process which concerns the totality of the structure of knowledge."

Two crucially important points are made in the above quotation. The first is the explicit caveat that no structure or operation can be investigated and understood removed and in isolation from the system which defines it as an entity. That is, in order for a cognitive behavior to "make sense" it must be seen as part of a more global cognitive activity; isolating it, as does the biologist who studies the tissue culture in *vitro* in the test-tube, merely serves to distort the reality of its function(s) as part of a living, thinking organism. This organism, furthermore, is an actively self-regulating open system whose process of adaptation – this progressive tendency toward ordered development – tends in the direction of what Furth (1969) calls "a dynamic integration."

It is here that language as an identifiable cognitive behavior must be studied in relation to identity and memory, both of whose structures undergo progressive changes as the child develops. The dynamic complexity of these relationships can be clearly seen in the young child as the changing memory structure establishes a "new" response at varying age levels. Consequently, to speak of language development *per se* or identity alone is a contradiction of wide proportions.

The second important point made by Piaget in the comment cited above is the stress laid on the biological components of development, what Piaget refers to as embryogenesis. Waddington, a British geneticist, suggests (1961) that the processes which are involved in the growth of living things can be subsumed under the three categories, or "biological time scales," of evolution, heredity, and development. Development, within his paradigm, is very much a part of not only the growth of a particular living thing, but is also an integral component of the very life cycle itself.

The system of development, says Waddington, is a dynamic enterprise. Embryonic cells are constantly in process, ultimately responding to an "organizer which may switch them into developing as a nervous system or not. If they are left too long without being acted on by an organizer, their readiness to respond will disappear again. There is only a certain phase in their progressive changes in which they are, as we say, 'competent' to react."

Within this so-called "competence" Waddington suggests a "path of change which is determined by the initial conditions of a system and which once entered upon cannot be abandoned." This path, or "creode," refers to a "trajectory of progressive developmental change, which arises from the nature of the causal organization at their starting point . . . . (1960)."

Importantly, development is *not* inflexible and in fact the developmental pathway (creode) manifests an equilibrium between inflexibility ("tendency to reach the normal end-result in spite of abnormal conditions") and flexibility ("tendency to be modified in response to circumstances"): the course of development "tends to follow its normal path . . . ."

The organization of the development of the organism thus depends upon relatively ordered structures of growth, following foreseeable if not predictable pathways; the processes occurring within each creode, however, are susceptible to certain environmental modifications while retaining the "normal" biological thrust inherent in the particular structure itself. The interactive process of the system – a cybernetic arrangement of interacting systems – serves to "induct" or "evoke" the potential in much the same way as genes serve to potentiate as a result of their enzymatic interaction. Yet, it is precisely because of this *potentiality* that, like genetic structure, developmental changes do not depend upon a predetermined end-point. We must, this attitude clearly suggests, interpret development – be it genetic, physiological, or cognitive – as it proceeds within the organized system of which it is a part.

The development of identity and the acquisition of language is here a case in point. Current research indicates that the

acquisition of language parallels the development of identity and in fact renders it meaningful (i.e., the path can be traced through the various pre-operational levels, remaining qualitatively consistent throughout the child's pre-operational period). Up to the age of 7 or so, the child increasingly makes "objective" sense out of the material at hand and his linguistic output reflects the stage of his cognitive development.

Identity development, crucial to the cognitively organized system within which language is expressed, is not merely a measurable quantitative change where accretions serve to cause the child to suddenly "grasp" the notions inherent in the transformations. The growth of *both* identity and language involves instead definitive qualitative changes: it is a "change of paradigm of thought, it is a developmental change and not simply the extension of a given category of knowledge (Voyat)." It is this "paradigm of thought" which is the creode of cognitive development.

This relationship is strikingly exhibited in an examination of the actual language used by children at various ages. Psycholinguists have categorized language use according to certain relational factors and Sinclair-de-Zwart (1969) has been most instrumental in studying these scalars and vectors in relation to Piagetian theoretical findings. Work by Sinclair-de-Zwart indicates that the style of reasoning utilized by a child is very much related to the language used; that is, what she calls scalars and vectors do not occur haphazardly throughout a child's language production, but very directly reflect the child's stage of language development. She found, in addition, a close relationship between the structure of a term and the developmental stages of seriation. Thus, for example, younger subjects responded as follows: "This is big, this is small; that's long, that's short." In contrast, older children tended to rely more on vectors, on more directly relational structures: "This one is bigger than the other; that's shorter than this one."

In a recent study by this author (1971), responses were arranged according to four categories:* Scalar one (S_1), Scalar two (S_2), Scalar three (S_3), Vector four (V_4). An example of each is shown below.

S_1 (Ty – age 3-2)

E) Is it (clay snake) like that one?
T) (Nods yes)
E) How come it's like that one?
T) This one's big and this one's small.
E) ... is that like that one or not like that one?
T) Not like ...
E) How come?
T) Because this one's big so it can't match.

S_2 (Heather – age 4-4)

H) I did it – I made this just like this.
E) What about them makes them look like each other?
H) I don't know.
E) You tell me – why?
H) Because they're both bigger.

S_3 (Victor – age 5-7)

E) Is that (arc-wire) like that or not like that?
V) It's like that.
E) How come it's like that? You tell me why it's like that.
V) It's more straighter and this one is more rounder and this one is a little rounder.
E) So is it like that or not like that?
V) It is.

V_4 (Leila – age 6-0)

E) How else is that one like that one (arc-wire)?
L) They're both green.
E) What about their size?
L) One's bigger than the other.

What is interesting here is that these examples indicate a trend or thrust rather than any kind of inflexible unidirectional isomorphism. The qualitative within-stage changes which these results suggest further illuminate the importance of emphasizing the role of the creode in development. For, contrary to a number of Piaget's critics, development is here portrayed as the *process and end-product both*, not in any mandatory, *ex cathedra* manner, but as a sensitive barometer of the child's current position in his/her particular stage of cognitive enterprise.

Further, the data strongly suggest that language is structured by thought and logic, that it in fact is not the well-spring from which logic comes forth. Cognitions develop beginning with the sensori-motor period culminating in their qualitative development in the logical coordination of actions. Vector four appears to represent the linguistic expression of the ability to "coordinate" heretofore cognitively unrelated dimensions; what has been assimilated is now likewise accommodated.

The above examples begin to make clear the interactive, progressive processes which in effect define the level and structure of cognition. They furthermore underscore the fact that cognitive operations (whether identity or otherwise) never exist in isolation, and that one operation (in this case, identity) is intimately related to and in fact is in effect another operation (in this case, language). The nature of the interrelationship (one could almost call it the

*Scalars are separated comparisons of objects with a gradually increasing directly expressed relational interaction between then. Vectors clearly indicate a level of intended and reciprocal relational interaction.

identity of the identity) is such that the acquisition of the one enhances – or potentiates – the acquisition of the other. In this manner we can investigate the hierarchy of operations – the path of competence – while simultaneously paying attention to the ongoing internal actions which evoke that development described above. An organismic, multi-component process based on interactive cybernetic principles, it is nonetheless a system which is open to the flow and input of the environment.

Piaget, Elkind and Flavell (1969) suggest, elaborates a "process of changes in the structure of behavior and of thought that come with the infant's or child's interacting with his circumstances . . . Orderliness in the course of development derives not only from genetic preprogramming, but also from the nature of the manner in which these ready-made sensorimotor systems are capable of being coordinated and differentiated in the course of the infant's interaction with his environmental circumstances."

Both the theoretical justification and tentative conclusions from the empirical data establish the evidence for assuming that "the world of the child is qualitatively different from the adult . . . (it) is not merely a clause of style, or an image; it reflects a reality (Voyat, 1971)." But the determination of an understanding of the cognitive operations just discussed leaves open the possibility, nonetheless, that the child's development of operations is of a quantitative nature, merely experience piling upon experience. Identity might be explained, then, as the repository for true learning experiences while language is a reflection of the developmental maturity, or immaturity (i.e., lack of experience), of the child. In this manner, a parallel, separate development is postulated, growth occurring because of the richness of the soil, perhaps, or the quality of the seed.

This postulation, however, ignores the specific *adaptive* nature of operative actions and undermines the epistemological foundations which are clearly evident in Piaget's empirical formulations. Specifically, "the biological function of knowing a thing in the environment is to react to the thing in an adaptive manner . . . We think in order to act (Furth, 1969)." We can see the justification for these remarks in our observations of children in the preoperational period where their knowledge is still determined to a primary extent on external conditions of action. It is not, however, total knowledge dependent upon action.

Work by Voyat (1971) provides evidence for this. Working with Sioux children, Voyat administered two series of the seriation tasks. After having the children respond spontaneously to the task he provided each child with information designed to enable the child to correct any errors he had made. Four modalities of learning emerged from the experiment, with each child virtually superimposing his/her modality of learning on his/her particular operatory stage. That is, "the child was unable to learn more than what his operatory level allowed him to (Voyat)." The provision of feedback is apparently not sufficient to enable a child to integrate information from a "higher" level. The results seem to point up the strength of the relationship between the ability to integrate information and a particular level of thinking. " . . . . one must wait" in short, "for the child's operatory structure to develop to observe the incidence of other modalities of learning."

What does Voyat mean that "one must wait for operatory structures to develop to observe the incidence of other modalities of learning"?

To begin with, we must accept the necessity of investigating the development of operatory structures through a scheme which is itself changing as the child grows. Memory is a cognitive behavior which elaborates the qualitativeness of the development, in contrast to the apparent quantitative cognitive growth, of the human child. In the above Sioux research we have seen illustrated the difference between learning and development: the latter as the "totality of the structure of knowledge," the former as "provoked by situations." It is in this integrative context that those data serve to extricate the sequence of the development of the memory schema and place it squarely within the developmental confines of identity and language. In addition, it underscores the Piagetian tenet that the child is "only" capable of assimilating and accommodating to that which his/her operatory level allows him/her to do. It is only under the circumstances of the changed and changing schema that memory becomes not more accurate but more in concert with the other same-level cognitions and modalities of thinking. The child remembers what the schema "allows" him to remember.

As Inhelder points out (1969) and as the previous materials suggest, internal mechanisms such as memory are generally thought to involve encoding and decoding properties. Thus, for those investigators who assume that memory is a direct copy of reality, the stability of the code would result in stability of memory. However, Inhelder's seriation results as well as the present conjectures support the assumption that the structure of the code actually changes "in the course of, and perhaps as a function of, the evolution of thinking operations . . . ."

Furthermore, we can now knowledgeably respond to Inhelder's implicit question: does the change in the structure of memory depend on specifiable laws or does it stem from developmental changes in the cognitive structures themselves? When we speak of recognition, evocation or, in this case, reconstruction memory we now know, and can specify, the memory image, symbolization and identity operations which make up the growth of the cognitive structures under investigation. The coordination of the operative aspects (actions, operations) and the figurative components (imitation, images) provide the vehicle for this growth.

Thus, the observation of qualitative differences of behavior at different chronological levels establishes memory as possessing the structure(s) through which identity is assimilated and language accommodated. Inhelder says that "memory is the apprehension of that which has been experienced or acquired in the past and implies the conservation of schemes of intelligence as well as conservation of biological mechanisms (1969)." The circle becomes complete. In the case of reconstruction, as well as recognition and evocation, dependence on the memory images and the immediate stimulus configuration varies, with reconstruction theoretically involving a balance of recognition and evocation. The memory trace, and its manifestation via increasingly accurate reproduction of the original stimulus, becomes a doubly integrative and integrated factor in the child's cognitive growth.

The development of memory further integrates the child's cognitive growth (see, e.g., Inhelder, 1971). But, in addition, it gradually and developmentally integrates the linguistic representation (which is stage specific) with, ultimately, accuracy of stimulus reproduction. In this way it preserves and integrates the developmental with the genetic and evolutionary -- it is truly an epigenetic phenomenon intimately tied to the mechanics of knowing: language, identity, and memory as epistemological equivalents. "The introduction and mastery of specific symbol systems represent landmarks in this transition (e.g., from Scalar 1 to Vector 4 . . .) but it is the essential continuity of the developmental process which must not be overlooked (Zimiles, 1963)." Stated a bit differently, we can understand the integrating-organizing process as one of the products of cognitive development. "The subordination of discrete experiences to an organizing principle," notes Schnall (1966), "rests upon cognitive differentiation and hierarchic integration, achieved by the organism in the course of his life in relation to changing environmental opportunities." " . . . development," says Piaget (Voyat, 1971), "is a process which concerns the totality of the structure of knowledge."

We are now only at the threshold of understanding the intimate relationships between the process and the structure. Studying identity, language and memory is one way to begin.

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The Corresponding Effect of Egocentrism on Concept and Social Development in Young Children

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The process of socialization has unfortunately been an area of only incidental concern in Piaget's writings. This is an expected result of Piaget's observations, though, since the main direction of his investigations has led him to search for the determinants of the acquisition of knowledge. However, although not directly involved in studying the social process of development, Piaget does recognize the impact of socialization on the child's cognition. (Piaget, 1969). Furthermore, if significant correlations can be discovered between concept development and social development, then we have a new perspective by which to examine Piaget's theories. With this line of thinking, a comparable stage-level theory of social development may also be forthcoming.

A preliminary research project has been carried out to examine these relationships between concept and social development. However, an analysis of some of the work already done in this area will be undertaken in the following paragraphs as a prologue to the report of this hypothesis and results.

Piaget's *The Language and Thought of the Child* (1926) served as a springboard for these investigations. There are several reasons for such a beginning. First, it must be recalled that we are concerned at this point with the possible correlation that exists between cognitive level and social developmental level. It seems that Piaget has satisfied sufficiently the requirements for a developmental model of cognition to be applied in this investigation. His extensive work in the investigation of cognitive processes supports this. Secondly, in *The Language and Thought of the Child* (1926) Piaget's observations overlap some areas of social development (primarily communication and egocentrism). This will help provide a structure by which any correlative results between concept and social development can be closely checked for construct validity within Piaget's theory.

Piaget (1926) derived three basic findings from his investigations:

1) Egocentric speech, defined as speech without an obvious communicative purpose, was found to comprise over 50% of the speech of the child under seven.

2) Genuine argument and collaboration were not found to intervene in the child's speech repertoire until after the age of seven.

3) Children between the ages of six and eight had great difficulty in tailoring explanations to their listener's needs.

These findings taken alone indicate the extent to which egocentrism pervades the developmental processes of the young child. Other studies by Piaget, notably *The Moral Judgement of the Child* (1965) and *The Child's Conception of Space* (1948), demonstrate that egocentrism orients the child's thinking to meet his needs. Hence, the child's failure to differentiate in the early preoperational stage between speaker's and listener's needs makes it possible for him to exercise the use of language for his own needs.

Eventually, as Piaget (1926) puts it, "intelligence, just because it undergoes a gradual process of socialization, is enabled through the bond established by languages between thoughts and words to make an increasing use of concepts (p. 45)." Studies in the literature tend to support the general direction of these findings.

Weinberg (1963) predicted that performance on a task measuring egocentrism could correlate with behavior on tasks which measure more obviously cognitive factors. His study, utilizing a group of 6- and 7-year-old children, demonstrated a relationship between relativistic thinking and egocentrism manifested on categorizing tasks. In another study, Neale (1966) derived results indicating that emotionally disturbed children display greater egocentrism than their "normal" peers. These results indicate that more work may be fruitful with different groups of children on varying tasks of egocentrism.

In addition, Bobroff (1960) succeeded in describing the developmental sequence of stages encountered in the socialization process. Levels of social development in Bobroff's data were narrowly defined by the criteria of knowledge and practice of rules in games. The results of this study pose the question of seeking the determinants of social behavior, which develops in stages.

Piaget's results, supported by these findings, pose a logical proposition. If the use of language for communication and cognitive performance coincide and language as communication increases along with level of cognitive performance while egocentrism decreases then a process may be operating to account for this pattern.

A study has been designed to investigate this proposition

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and by logical inference lend support to the conclusion that a process is operating which can account for this pattern. Expectedly, this process may resemble learning transfer. If so, developed social and cognitive concepts must have similar attributes for transfer to occur.

A group of normal pupils compared with a group of gifted pupils were tested on three Piagetian tasks and a measure of social abilities. Piaget predicts accelerated acquisition of concepts in gifted children (Philips, 1959). Assuming this prediction to be true it was hypothesized:

1) Concept level on cognitive tasks and the level of socialization measured by a test of role playing ability is significantly higher for gifted children than for their average peers.

2) Egocentrism, as measured by Piaget's task of spatial perspectives, is negatively related to scores on a test of role playing ability.

3) There is a stronger positive relationship between the cognitive task measuring conservation and role playing ability than between the other tasks and role playing ability.

Method

In order to test these hypotheses 20 subjects were chosen from two thirdgrade classes at Main Street School, Wyoming Valley West School District, Kingston, Pennsylvania.

Initially, 5 boys and 5 girls were randomly selected from a normal thirdgrade class for the control group. These were matched for sex and age with 5 boys and 5 girls from the 3rd level gifted class. Age, matched to the closest month, was equal in five cases, one month apart in four cases, and two months different in one case.

The subjects were interviewed individually. An interview consisted of the administration of three Piagetian tasks and a test of role playing ability. Performance on the Piagetian tasks was recorded on score sheets and the role playing test responses were taped.

The three Piagetian tasks were chosen for both their diversity and ability to provide an overall assessment of cognitive level.

The first was Piaget's task of spatial perspectives (Piaget & Inhelder, 1948). Generally this task measures the child's ability to assume varying points of view around a mache model of three mountains without changing position. Piaget also interprets performance on this task to indicate level of egocentrism or lack of it. Instructions for the construction and administration of this task which appear in *The Child's Conception of Space* (Piaget, 1948) were followed.

The second task was found in the same volume (Piaget, 1948, p. 271-297). The child was presented with five geometric figures and asked to draw them as they would look if opened flat on the table. The level of performance obtained indicates the child's ability to "rotate and unfold surfaces onto the frontal plane (Piaget, 1948, p. 271)".

The third task was an adaptation of Piaget's attempts to measure the child's conservation of volume (Flavell, 1963, p. 298-341). The child was given four clay balls, each half as large as the next, and was asked to predict what would happen when they were placed individually in a beaker of water. Finally, the shape of the largest ball was changed to a sausage and the child was asked whether it would now change the water level to the same degree he observed earlier. The sausage was once again returned to its ball form and the child again predicted its affect on water level.

The Dramatic Acting Test (DAT) developed by Perry London of U.S.C. and Patricia Bowers of University of Illinois was utilized next to measure role playing ability. Generally the DAT follows the principle that "to gain social perspective a person must be able to put himself realistically in another's place (London, 1965, p. 500)." It is primarily because the DAT measures such a well defined area of social ability that it was chosen for this experiment. Role playing ability, as measured by this test, represents an important part of the socialization process.

Essentially, the DAT consists of six short playlets. Each subject is given standardized instructions. At the beginning of each sequence the experimenter sets the scene and announces the roles both experimenter and subject must play. These include a friend, enemy, mother, father, teacher and sheriff. The experimenter begins by reading the first few lines and the subject ad-libs. Action continues for about one minute.

Each subject was administered the three Piaget tasks and the Dramatic Acting Test in the order just mentioned.

Results

After all subjects were interviewed, results were tabulated and scored. The DAT is scored by comparing responses to a scale and assigning a score of one through four for each response. Scores are averaged for each play and a total score is obtained by adding the totals from six plays. Thus a range of scores between 6 and 24 may be obtained. Scorer reliability was not checked due to the clarity of the scoring system provided.

The three Piagetian tasks were scored by assigning stage levels of either I, IIa, IIb, IIIa, or IIIb for each task. Generally, scoring of this nature is more difficult since there are no objective scales to follow. All subjects were scored on these tasks by myself and an experienced collaborator according to general protocols established by Piaget. Each scorer assigned levels independently and the results were checked for discrepancies. The few disagreements which appeared were discussed and adjusted accordingly. The only disagreements which did occur were between two successive stages and occurred in both directions, i.e. there were instances in which the author's stage level was highest of the two scorers, and other times in which the collaborator's stage level appeared higher.

The stage level of the control group on all three tasks ranged

from 2A - 3A. Fifty percent of these scores were at level 2A. The Dramatic Acting Test scores of this group ranged from 10 - 20.

The stage level of the gifted group on all three tasks ranged from 2A - 3B. Fifty percent of these scores fell at the 2B stage level. Dramatic Acting Test scores ranged from 17 - 22.

The sign test (Siegel, 1956) was applied to stage level and DAT scores between matched subjects. The gifted group scored significantly higher in the expected direction on Tasks II and III and the DAT. These results were significant at the .02 level and beyond. However, differences on Task I were not significant ($p = .055$).

Subjects within each group were classified according to stage level on each of the Piaget tasks and the Jonckheere test for ordered alternative hypotheses (Siegel, 1961) was applied to their DAT scores. The relationship between DAT scores and Task III, conservation of volume, was significant at the .05 level for the control group. None of the other relationships tested was significant, and no significant differences were found between sexes.

Discussion

General support is demonstrated by the above results for Piaget's prediction that "gifted" students will be accelerated in the area of cognitive development over normal students. In addition, the gifted group also scored higher on the role playing test, bearing out the expectation that socialization will increase with concept development. Thus the first hypothesis was supported.

Hypothesis number two, that egocentrism in the task of spatial perspectives would be negatively related to social development, was not supported. This result may be partly due to confusion in administration of one part of that task. Specifically, the children had difficulty in arranging the cutouts which simulated the various shapes of the paper mache mountains. In replication, cones could be used to represent the mountains in cutout form so that this difficulty may be avoided. Also in testing city children on this task more reliable results could be achieved by using tall buildings in place of mountains.

Finally, hypothesis three was supported. The relationship found between Task III (conservation of volume) and the DAT in the control group indicates that a process may be operating to account for this finding. It must be noted, though, that because of the small size and unequal groups at the stage levels within each task the probability estimate may be off. However, the need for more research in this area is indicated.

It is hoped that this study will at least pave the ground for further investigation. Having an interest in the exceptional child, the author believes a theory of social development along the lines of Piaget's cognitive theory will be an aid to the special instructional problems encountered with these children.

On the basis of these results, a replication of this study is intended with tasks of conservation of volume, quantity and so on with a larger longitudinal sample. This further work should define even more clearly the correlates of social ability.

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Piagetian Theory and Imitative Behavior in Childhood: Directions for Parent-Infant Education

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Piagetian theory provides direction and support for an early identification, early intervention focus for special education. Such a focus is certainly more optimistic than the more traditional remedial construct.

Piaget's early research (1951) on child development included the study of play and imitation in childhood. The increased attention given this research by those involved in early childhood development and education is a sort of renaissance if we consider the years which have elapsed since the work of Pastalozzi, Froebel, and Montessori. The lag between Piaget's early studies in the 20's and 30's and the recognition of that work is another case in point.

In special education, early childhood programs have included training for parents as well as children in the belief that "around the clock" attention to the needs of the child is necessary. Educators of the deaf have been especially concerned with earlier educational intervention in light of the devastating impact of deafness on the child's communication processes. In California, there are approximately twenty federal or state funded public projects, and some private programs for deaf infants and their parents. The children served range from six to thirty-six months in age. A commitment to the need for early identification, early intervention, and to theories concerning critical and/or sensitive periods in the child's development constituted the rationale for initiation of these programs.

Program objectives include the provision of guidance and training for parent and child to enhance their relationship and to facilitate the child's movement through normal developmental sequences in sensory motor, cognitive, linguistic, and social areas. The emphasis is on sequences rather than on age-related norms. The sequences proposed by Piaget (1952) concerning cognitive development have already proved to be a valuable resource for educational planning, and I believe his study of imitation and play in childhood also provides direction for curriculum construction.

Since parent-infant programs focus on the child between birth and three years of age it is sensory-motor development and the early stages of representational cognitive processes which are of concern, and for this reason the development of imitative behavior, which is a basis for all learning, is particularly pertinent. Piaget (1951) spent considerable time closely observing and analyzing the imitative behavior of the very young child. The theories he formulated to account for the sequences he observed are especially important for parent-infant education.

The following sequence of stages in the development of imitative behavior is based on Piaget's (1951) study.

Stage	I	Reflective or contagious imitation	0 to 1 month
	II	Intentional sporadic imitation	1 to 3 months
	III	Intentional systematic imitation of sounds and movements within child's repertoire	3 to 8 months
	IV	Imitation of movements within child's repertoire which he cannot observe himself performing (coordination of elements) and, beginnings of imitation of new auditory and visuo-motor models	8 to 10 months 10 to 11 months
	V	Systematic imitation of new auditory and visuo-motor models	12 to 15 months
	VI	Deferred imitation and beginnings of representational imitation (interiorized coordination precedes external manifestation)	15 to 17 months

Stage I Reflexive or Contagious Imitation 0 to 1 month

According to Piaget, this is not true imitation. If an infant begins to cry when in the presence of other crying infants, it appears to be a sort of contagious or reflex response. The infant does not yet perceive himself as a separate unit, and therefore does not realize that the cry he experiences is not his own. Piaget suggests that the child perceives the cry as his own and merely continues it. The sound of crying serves as a sort of behavior releasing mechanism. There is no attempt on the part of the infant to reproduce the exact sound he experiences.

Stage II Intentional Sporadic Imitation 1 to 2 months

In differentiated crying or vocalization, the infant is apparently imitating his own sounds. He appears to reproduce sound for its own sake. However, in order to imitate or reproduce his own sound, the infant must first perceive that *he* is making the sound; have become aware of some coordinated vocal and breath movement necessary to produce a facsimile of the sound, and then perceive the imitation to be similar to the previous sound. We can see that the infant is already performing a relatively complex cognitive operation. An example of this is the difference noted between the infant's cries when he is hungry, and when he is tired.

The same pattern is reflected in visuo-motor behavior in such behaviors as putting the thumb in the mouth, and focusing on moving objects.

A second phase in sporadic imitation is mutual imitation which occurs when someone imitates the infant's sound *while* the infant is uttering it. Piaget observed that the infant then appeared to be stimulated to persist in making

his own sound. In this instance, the infant does not attempt to approximate the outside stimulus but rather to continue his own previously uttered sound.

Mutual imitation is important in terms of intervention strategies which might insure that the exceptional infant is encouraged and reinforced for making and imitating sounds even with reduced sensory motor input.

This elementary form of imitation provides the basis for the child's gradual expansion of his repertoire of experiences. Experimentation with sound, in deaf infants, and with movement in case of blind infants would be expected to be restricted due to reduced perceptual experience, and the consequent loss in intrinsic reinforcement. In cases where early identification has been made, parents could be directed to provide extrinsic reinforcement and alternate perceptual experiences in order to sustain these beginnings of imitative behavior, which are prerequisite to later development.

Stage III Intentional Systematic Imitation 3 to 8 months

During this stage the infant systematically and persistently imitates sound and movements already in his repertoire. With increasing coordination of auditory-vocal and visuo-motor processes the infant becomes much more accurate in imitation. He builds on the isolated sounds and movements he has through accidental combinations of them into new sounds and movements. The infant does not yet demonstrate accuracy or persistence in imitating new models presented to him, but appears to concentrate on expanding his own repertoire through experimentation.

The infant appears to delight in imitating familiar sound and movements presented to him. This ability indicates a marked increase in discrimination and recognition of sounds and movements and suggests that the infant has a memory for coordinations necessary to reproduce them.

Piaget suggested that the child at this stage does not analyze the elements involved in these coordinations but rather perceives them as a unit, a gestalt. It is not until around eight months that the infant appears to intentionally coordinate elements in a given vocalization or movement.

Around seven or eight months, the infant begins to imitate movements others make which are similar to his own, and which he can observe himself performing. For example, the infant can imitate moving hands together and apart, but not sticking out his tongue. The incidence of sensory deficit, extreme retardation, or physical involvement can generally be determined by six to eight months. It is during this stage that noticeable differences in response to stimuli in the environment have been noted in exceptional infants. For example, qualitative and quantitative differences in vocalization and attending to sound in deaf infants, marked retardation in sensory motor behavior in blind and seriously retarded. Again intervention strategies which reflect the normal imitative behavior patterns are indicated.

Stage IV a. Imitation of Movements Which the Infant Cannot Observe Himself Performing 8 to 10 months

When the infant is about eight months of age he begins to imitate movements made by others which he *cannot* observe himself doing; e.g. sticking out his tongue, opening and closing his mouth. However, to sustain the imitation, that is to insure its spontaneous repetition, the infant appears to need training and practice. The infant does not immediately make the necessary association between his own mouth and another's mouth, for example. This ability to repeat movements without being able to see himself doing so implies a beginning in analysis of the behavior in question. Whereas the infant was able in Stage III to imitate an immediate visuo-motor movement he was probably not perceiving the model as separate from himself, but rather as a continuation of his own. For example, in imitating the bringing together and moving apart of hands, the infant seemed to be aware of the model's hands rather than his own, or perhaps, it would be more accurate to say, he saw both sets of hands as one unit. In Stage IV, the infant appears to: 1) observe and attend to the movement, 2) make the association between some aspect of the model's body and his own, 3) internalize the movement he observes, 4) and reproduce it by coordination of the relevant elements, e.g., mouth, tongue. Whereas, in Stage III, the movement was perceived as a gestalt, in Stage IV, the movement is percevied as a coordination of separate elements.

b. Beginnings of Imitation of New Auditory and Visuo-Motor Models 10 to 11 months

In order to imitate a new model, or new coordination of existing behaviors, the infant must have the capabilities necessary for that coordination. He must possess the separate elements involved in the new model. Piaget sees this new model, then as a re-combination of already learned elements (schema) whereas up to now the infant, through play and experimentation, has arrived at new combinations of his own previously learned elements, he is now ready to imitate new models through *intentional coordinations* of previously learned elements.

The new model should not be too dissonant or incongruous to existing behaviors of the infant. The factor of dissonance in learning has become studied by Festinger (1957) in his "cognitive dissonance" theory, and by Hunt (1961) in his investigation of the need to establish a 'match' between the child and the experiences. Dissonance research indicates that in providing experiences to stimulate infant imitation, the relationship between that experience and the child's existing knowledge must be taken into account.

Piaget also stresses the need for the child to make tentative investigations of new sounds and movements and for ample opportunity to practice them. In this regard stimulation, reinforcement, and encouragement by parent and teacher of the exceptional appears to be a necessity.

Stage V Systematic Imitation of New Models, and Beginning of Association of Meaning to Sounds 12 to 19 months

The child is now able to coordinate more and more elements in imitation of new and more complex models. He can coordinate visuo-motor and auditory-vocal processes in a single behavior. He begins to perceive uses for schemas (movements or vocalizations) e.g., "ga-ga" for water; pulling a string to reach an object. The child also begins to associate meaning to sounds he makes and hears, that is, he is beginning to use sounds as words. This stage is characterized by re-combinations of familiar behaviors and experimentation in terms of use. The child's increased mobility provides a wider range of models and experiences, and his ability to attend to more complex stimuli provides constant stimulation for imitation and experimentation.

Piaget draws a parallel between imitative behavior and the overall cognitive development of the child. As the child becomes more aware of himself as separate from the environment he becomes more objective in his perception, and thereby, more objective in his imitative behavior. In Piaget's view the child up to this point has not achieved true imitation but is moving toward it as he becomes more objective.

Stage VI Beginnings of Representative Imitation and Further Development of Imitation 15 to 18 months

Deferred imitation is imitation by the child of a sound or movement or some combination of the two, sometime after he has seen or heard them. The child appears to internalize an image of the model (visuo-motor, auditory, kinesthetic) in memory, which he then recalls at a later time. This is the beginning of representative imitation and reflects a difference in the degree of proximity to the stimulus. The child is also able to imitate complex new models, almost immediately, e.g. crossing arms and nodding head. New sound combinations are used correctly in deferred situations, which is a manifestation of increased discrimination ability and auditory memory.

Piaget notes that this stage coincides with early symbolic representational development. The child begins to use symbols to represent his experiences. These symbols are largely images, or what Piaget calls signifiers, i.e. they are related to the object they signify by some resemblance. These symbols are largely subjective or personal in nature. The child at 15 to 17 months is also beginning to use words (arbitrary, objective, impersonal signs) to represent his experiences. However, the child still relies largely on imagery at this level.

From about 18 months through six or seven years, the child continues to imitate and also participates in make believe play (ludic symbolism) and role playing. The child, now more socially oriented, becomes greatly influenced by the person providing the model for imitation. If he holds the person in high regard he tends to emulate him in many ways, rather then in isolated instances.

In addition to the personal regard for the model, the decrees and extent of the child's voluntary imitation are affected by proximity, consistency, and congruity. The child tends to be influenced by persons most frequently in his environment; and to imitate models which are consistently repeated, and are congruent with his previous experiences. Imitation continues to play an important role throughout the development of the child, indeed, throughout life.

In summary, let us consider these beginning stages as they pertain to Parent-Infant Education. Several factors discussed by Piaget are particularly relevant to educational intervention.

1. Imitation seems to be an inherent or characteristic behavior in children.
2. The very young infant can imitate only that which he himself has first performed.
3. The child seems to be motivated to imitate by a desire to continue the experience. The experiences therefore, appear to be intrinsically motivating.
4. Pseudo-imitation or elicited imitation may produce qualitative and quantitative increases in the child's imitative behavior.
5. Pseudo-imitation is sustained by repetition and practice.
6. The child's first experiments with, and investigates his own production, and *then* begins to experiment with new models.
7. The dissonance factor in new models affects the child's willingness to imitate, and his success in imitation.
8. The child needs to be proficient in the separate elements within an activity before he can coordinate them into a new activity.
9. As the child becomes more socially oriented, the regard he holds for the person who serves as a model becomes a critical factor in imitation.
10. Imitative behavior parallels cognitive development.

These statements reflect a sample of the direction provided by Piaget's work on imitative behavior, and early child development generally, for educational planning. A more exhaustive study is beyond the scope of this presentation. The need for early identification and early intervention is clearly demonstrated. Pseudo or elicited imitation can be effectively implemented with very young exceptional infants and children. In instances of reduced sensory motor input parents can provide increased and/or alternate models to stimulate the child's imitation. Parents and others must be alert to the child's efforts, and should reinforce and expand them immediately.

Care must be taken to guide parents and teachers in "natural" intervention techniques which do not strain parents or child. Home demonstration should begin early, and be maintained

on a regular basis until the child is ready to go to school. In the earliest stages, models should be based on the child's own efforts, in agreement with the normal sequence. In later stages, when new models are introduced, attention must be given to the existing capacities of the child in terms of coordinations which may be involved.

As the child reaches 12 to 15 months of age, the persons who will most frequently be available to the child should be involved in the training program. At this stage, children tend to reject mothers and fathers as teachers, because the role is not consistent with the child's concept of the role of parent. The same holds true of the teacher in the home. Therefore, it is imperative to freely move both teacher and parent in and out of both settings so that the child will learn to accept them in their dual roles.

The last statement regarding the parallel development of cognitive and imitative behavior might appear to be an oversimplification. However, in terms of intervention it is crucial to consider the cognitive level of the child in selection of models for imitation. The models must be consistent with the child's capabilities and experiences, and build upon them.

In conclusion, I would like to suggest qualities which I consider critical in selection of models (behaviors) for imitation.

Models should be:

Discriminable
Familiar; related to child's own experience
Consistent in form and meaning
Interesting
Reinforcing
Desirable in eyes of the child
Within the child's capabilities
Immediately and frequently available.

If we then provide freedom to experiment and investigate, reinforce and expand the child's efforts, provide acceptable intervention models, we should be able to effectively enhance the child's learning and enjoyment of life, and to provide direction and reassurance to the parent.

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Spatial Education for Blind Children
An Application of Piagetian Concepts

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Early childhood education should expand the blind child's field of possibilities. The crucial time for developing the capacity for spatial abstractions, symoblism and language is during the preschool years. Because of the absence or reduction of visual imput, physical experiences may be limited. Spatial relationships are most difficult for blind children to learn. The sighted child utilizes his vision for much of the sensory data necessary for abstracting relationships among objects and events. Spatial education for the visually impaired child provides experiences for the development of spatial reasoning through activities which incorporate its relationship to concepts of movement and time.

One of the basic functions of an early education program is to facilitate the transition from sensorimotor intelligence to conceptual intelligence, thus building a solid foundation for future orientation and mobility needs. Blind children entering the preschool years, those who received successful motor, perceptual and language intervention during infancy have: 1) coordinated their existing sensory schemata, established object permanence and ear-hand coordination; 2) mastered the basic skills of manipulation, postural adjustment and locomotion; and 3) developed the beginning of both symbolic imagery and verbal signs. Essentially with the ending of the sensorimotor period the blind child is now able to move in and respond to his environment. These then are some of the incoming behaviors which can be expected for the development of intuitive spatial concepts plus those preoperational concepts of movement and time relative to the blind child's development of spatio-temporal relationships.

It is important to realize that " . . . representational space is not a simple internalization nor a purely image reproduction of sensorimotor space." (Laurendeau and Pinard, 1970, p. 11). While sensorimotor space is dependent upon perceptual-motor functioning and develops during the first two years of life; the gradual development of representational space, operational thought, spans all of early childhood and is not achieved by formal operations until approximately a decade later. This paper will focus generally upon activities during the preschool, preoperational years. Blind children have greater difficulty in coordinating actions concerned with transformations and compositions of their physical worlds. (Hatwell, 1959).

The blind child's kinesthetic-motoric experiences in moving his body are used to begin the systematic teaching of spatial relationships. Putting the mat *on* the table and the cup *on* the dish with the saucer *under* the cup are examples of learning object-to-object spatial relationships through movement. Getting *on*, springing *up*, sliding *down*, crawling *in*, *under* and *through* are examples of the child's spatial experiences with object-to-self relationships. Thus acting upon objects becomes the foundation for spatial learning.

Preschool education should combine both language stimulation experiences and the school day schedule for the initial development of *temporal* relationships. The daily schedule reinforces the concept of temporal ordering. *After* story time, for example, comes outdoor time, then refreshment time. Juice time again stresses order by its consistent sequence of events – hand washing *before* juice time. Children learn that *after* everyone is seated, juice and crackers will be passed. Every opportunity is used throughout the school day to develop the child's awareness of the sequence of time to events by discussing which activity has taken place before and which activity will follow after.

Constant labeling of spatial concepts, such as "on-off," "full-empty," and verbalizing sequential events, "before-after," "if, then and because" are important for building elementary relationships. (Sonquist and Kamil, 1968). "The pitcher of juice fills your cup *full;* and when you drink all your juice the cup will be *empty.*"

A word of warning is not to confuse relational concepts of time and space during the initial stage of abstraction. The lexicons *before-after* have meaning both in a temporal order – "What happened before and after?" – and in spatial order – "Who is before you or after you?" During the initial period of concept acquisition care should be taken not to confuse the lexicons within their separate spatial or temporal categories. Substitute words such as "in front of you" or "behind you" during these earlier experiences. Spatial or temporal generalization is required to formulate the basic concept, that of abstracting similarities and regularities. This must precede semantic generalization.

The preschool environment needs to be arranged so that the child's encounters with it will constantly involve interactions which are stimulating and intrinsically motivational. It is insufficient just to provide perceptual stimuli without providing opportunities for sequential responses programmed to the child's functioning levels – both motoric and cognitive. Programming stimulus difficulty and sequencing the hierarchy of responses are essential for effective learing. Principles for programming stimulus difficulty include: gross to fine stimulus differences and knowing their functions to construction of categories; real objects and their functions to recognition of models; gradual fading of stimulus cue support to reconstruction; and increase from two to larger stimulus groupings or categories.

The steps in sequencing the response hierarchy are discrimination, matching, recognition, recall and reconstruction. Long before children learn to classify objects into groups or

to arrange them in order, they perceive similarity and dissimilarity. Discrimination and matching are subiogical tasks of a spatial distribution and are present in sensorimotor intelligence; whereas, recognition, recall and reconstruction each require a mental image of the spatial form plus the verbal sign.

Discrimination is basic to conceptualization. If a child cannot discriminate on a perceptual level, he will be unable to later classify. Some shapes are more easily discriminated tactually than others. first, familiar objects such as a comb, spoon, ball, cup, etc.; second, topological shapes, irregular surfaces such as opened or closed surface, or a ring from a circle; and finally, Euclidean shapes which are differentiated by their length of sides, size of angles, number of elements, or parallelism of their sides. (Laurendeau and Pinard, 1970).

Children initially are not active tactual investigators. Younger children are content to grasp an object and pass it from hand to hand. A blind child needs to be taught early how to investigate objects actively, how to trace the edges, how to feel the entire surface in order to construct any image at all. One of their major channels will be tactual, the means by which to know an object. The role of haptic processing to cognition is dramatically illustrated in seriation. In the beginning there is not anticipation of size ordering, even by trial and error. The child perceives an object to be handled, pushed, turned over and piled. Initially the child simply stacks the blocks. At this level children make piles of objects.

Many activities lead to trial and error discovery of seriation. Preschool materials commonly provided are nesting toys, blocks or cups. The incorporation of real objects found in the blind child's home environment is important. Using cooking utensils assists the child in becoming familiar with their qualities and properties plus becoming familiar with the function of environmental objects. Sighted children see mother using these. The blind child must either find them during exploration or else have them presented to him. Sand play, using measuring cups, is useful both for ordering size and volume. Montessori cylinder blocks, which vary in length, thickness or both, are excellent didactic materials with their own self-corrective feedback system.

The intuitive period of cognitive development is characterized by correction through trial and error learning. The child typically lacks hindsight and foresight. For this reason didactic materials aid in corrective feedback. Pyramid toys encourage more active manipulatory hand movements in order to arrange the series of larger to smaller.

Tactile seriation is slightly retarded to visual, although its development is almost parallel to that of classification, and tends to precede it step by step. (Piaget and Inhelder, 1969, p. 4). To aid intuitive anticipatory attempts preschool materials are color coded. Educationally such stimulus support cues need to be gradually programmed out of the learning tasks particularly during the transitional period between preoperational and operational. During the intuitive period there is seriation according to one criteria. Serial correspondence is really just as easy as simple seriation. (Piaget and Inhelder, 1967). For a multiple seriation task the child is required to order according to size and according to color or texture. A serial matrix requires the series to be ordered along the vertical and horizontal axis. An important point to keep in mind, is that language accelerates the process of seriation and helps to complete it. (Piaget and Inhelder, 1969).

The intuition of space initially involves movement and mental images of that action. Movement provides the basic causal action performed upon the object, while the mental image is simply an internal imitation of that previously performed cause and effect. Later on, mental images provide the means by which actions are capable of being transformed without the didactic props of preschool education. The child must eventually free himself of the need for such perceptual support. The importance of the role of physical experience at the preoperational level should not be minimized. Through physical activity the child abstracts information about the objects themselves. Knowledge of the physical world results from physical abstractions. For the blind child the lack of sufficient physical encounters is probably more detrimental than the loss of vision.

The child's actions and the child's coordination of his actions both give information. Piaget theorizes two types of knowledge which are: 1) the resulting knowledge the child gains about the object's properties (physical abstraction); and 2) the resulting organization of the child's activities (reflective abstraction). (Piaget and Inhelder, 1969). The epigenesis of intuitive space is illustrated by the cumulative role that learning has upon the development of spatial concepts. Previously noted was the role of movement in the development of object-to-object and object-to-self spatial relationships. The child's motor activities provide the basic kinesthetic symbolic image. Hanging *up* your coat is an object-to-object relationship. Skating is an object-to-self relatioship. The blind child has greater difficulty in acquiring the "I" concept. The use of the pronoun "I" is interactionally related to the development of object-to-self relationships.

The next level is the recognition of body parts and body planes. It is here that the self-help skills of dressing and undressing play an important role. One of the best ways to know about one's feet is to put on your own shoes and socks – an object-to-self relationship which incorporates the principal of opposition. The child is required to arrange by one-to-one correspondence the right and left shoe to fit onto the right and left foot. This is not an easy task for preschoolers, but at this level we have lots of trial and error learning. The child does need verbal feedback, particularly if the shoes are on the wrong feet or else he may

not really know he is in error. Identification of right and left body parts demonstrates that the child *already* grasps the relationship of opposition, that of right and left.

Another difficult dressing skill is to put on a jacket or sweater correctly. As the child faces a pull-on sweater, the front faces him. Unless he can rotate the sweater's image 180°, the front will end up on his back. This task requires the ability to rotate an object in reference to self on a horizontal plane. If the child can identify the teacher's right and left hands while facing him, then this demonstrates that the child is able to coordinate his perspective on a one-dimensional plane of right to left and that he is able to internalize 180° rotations.

It is assumed that what the child learns about objects and movement in space will influence the way in which he organizes his own actions. Most children at the *transitory* state between preoperational and operational thought benefit from learning procedures. For this reason many learning experiences need to be developed and provided.
and provided.

Low-vision children appear to have greater difficulty in coordination of perspectives. (Swallow and Poulsen, 1973). To move in projective space adequately the blind child needs to be able to mentally coordinate objects in relationship to himself and to other objects. Although order is important to become familiar with an environment, a static-stable environment does not contribute to the growth of the blind child's spatial concepts. For the wagon to be found always in the same spot offers little opportunity to develop coordination of positions. "Where's the wagon?" the child asks.

"It's to your right on this side of the car, in front of the rear wheel." This response requires the child to mentally manipulate his spatial array of the playground and to coordinate positions in relation to himself. The car is a permanent reference point. The child is being provided an opportunity to actively move within his environment – developing his spatial concepts.

Intuitive space is really the gradual internalization of a spatial schemata already formed in the sensorimotor period. It is this slow development of representations of images that leads to spatial conceptual development and the means by which the blind child learns to cope with his spatial world.

In conclusion there is little doubt that visually impaired children need a program designed to meet their specialized needs plus preschool teachers who are competent in the art of teaching so that the appropriate activity is matched to the blind child's functional level. But basically the blind child is a preschooler with a visual defect just asking for his right to manipulate and explore, to speak and be heard, to love and be accepted.

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Spatial Education for Blind Children: An Application of Piagetian Concepts To Early Childhood Education

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Three graduate students from California State University, Los Angeles presented and discussed two classroom activities developed for spatial education, based upon the works of Piaget. One deals with the problem of *alternative directions of travel*. A ten minute video tape shows a low vision preschooler experiencing a learning activity for reversibility of directions and 180 degree rotation. The second specific learning activity concerns itself with the concept of *uniform speeds*. The learning model and the relationship of spatial development to movement and speed at Piagetian stages is included.

Discourse on the Non-Discovery of a Non-Method
By: Brian Neil Burg

Concept: Alternative Directions of Travel

Model and Format: The model consists of a wooden base and superstructure upon which is mounted a brass rod going through a small tunnel and containing two differently shaped wooden beads which can be pushed along the rod and through the tunnel. The tunnel is long enough to completely enclose the beads. Problems are presented in the form of moving beads into the tunnel and asking the child to predict which bead will emerge first from a particular side and after, for example, a 180 degree rotation. Blind children feel the beads as they go in and feel them as they go out after they have made their prediction.

Some Theoretical Issues: We considered each sequential problem as a separate discrimination task, based on the Skinnerian paradigm

$$S^D \longrightarrow R \longrightarrow S^{r+} \text{ or } S^{r-};$$

that is, a discriminative stimulus is the occasion upon which a particular response is followed by either a conditioned positive reinforcer or a conditioned negative reinforcer. This basic paradigm was combined with a notational format which we developed, enabling us to schematize each separate learning task as in the following example:

where $\square$ represents the tunnel and $\longleftarrow$ is the direction of travel of the beads AB. Note that the discriminative stimulus is composed of two phases arranged sequentially in time: a descriptive phase where the problem situation is defined (the beads in the order AB are inserted into the right side of the tunnel which is then rotated 180 degrees) and a question phase (in which order will the beads emerge on the left-hand side?). Together, they form a complex S^D which is unique for each permutation of the problem.

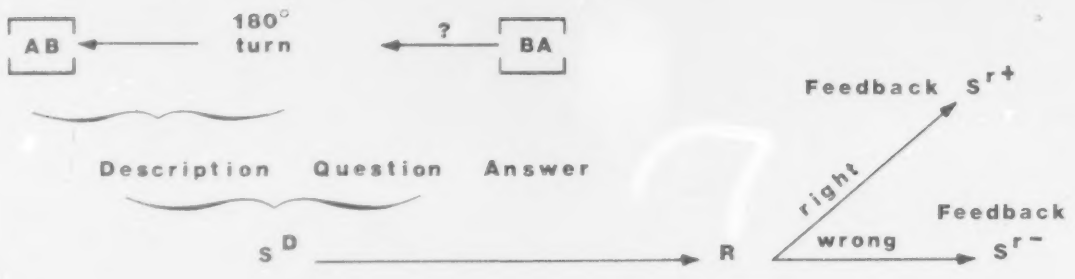
Piaget's diagnostic model broke the problem of alternative directions of travel into 7 basic parts; but, using the type of analysis as described above, we isolated at least 32 distinctly different questions corresponding to the first 5 of Piaget's questions. These broke down into 4 levels of difficulty, each level having 2 different types of problem, each one associated with 2 symmetric opposites (left-right reversals) and 2 order reversals.

Speculations like those on the preceding page throw grave doubt upon the completeness of Piaget's diagnostic model and, in general, raise more questions than can be answered. Clearly, well-defined empirical studies are needed.

Some Questions to Think About:

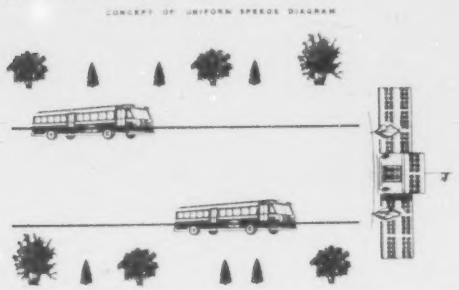
1) How many of the 32 distinct problems which we uncovered are necessary to ensure formation of the concept of alternative directions of travel?
2) What method should the child use to answer the questions? (We tried two: verbal response and matching to sample.)
3) What, if any, is the function of questioning the child during the learning activity?
4) Do stories function as a source of motivation or as a source of confusion?
5) What is the relation between this problem and the child's conception of time?

In short, our project can be summed up as follows:
If you've got the answers, we've got the questions!



Synopsis of the Concept of Uniform Speeds
BY: Shirley Newman and Ellen Bubrick

I. DIAGRAM:



*Not included in diagram are:

1) raised dividers to prevent bus from deviating from road.
2) two long sticks attached to rear of bus that control movement.

*Included in diagram are:

1) two buses
2) eight trees
3) one school
4) two roads

II. BEHAVIORAL OBJECTIVE:

Given a model which demonstrates the relationship between two moving objects travelling equal distances within an equal period of time at different speeds, the student, through a tactual media, will be able to independently verbalize that one object consistently travelled twice the speed of the other object, within the alloted twenty minute lesson.

III. CONCEPTUAL DEVELOPMENT:

1) Sensory Motor: (0-2 years)
a) No significant mental processes occur

2) Preoperational Level: (2-7 years)
a) Child acknowledges that one bus reached the school while the other did not.
b) Acknowledges simultaneous starting but not simultaneous stopping points.
c) Acknowledges that the journeys to travel are of equal length.

3) Concrete Operational Level: (7-11 years)
a) Acknowledges that one bus reached school while the other did not.
b) Comprehends that one bus was only half way to school.
c) Child acknowledges that one bus constantly moved twice as fast as the other.
d) Acknowledges that they started simultaneousiy and stopped simultaneously.
e) Comprehends that the roads are of equal distances..
f) Comprehends concept but is not free of all models.

4) Formal Operations: (11 years and up)
a) The child can now apply the concept to other abstract situations and is free of all models.

Relationship Between Piagetian Concept Of Conservation And Reading Achievement With Second Grade Children

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ABSTRACT

Reading readiness in the Kindergarten child has been found to be related to level of conceptual development as measured by Piaget's concept of conservation. It was hypothesized that reading achievement and conservation ability would also be related in the older child. A WRAT reading subtest and five measures of conservation were individually administered to thirty-six second grade children. A chi square statistic found no relationship between reading achievement and conservation ability. The high level of reading ability demonstrated by the experimental population confounded the results and increased the difficulty of firm conclusions.

A great deal of interest has recently been shown in Piaget's theory of child development. Much emphasis has focused on his concept of conservation[1] since, for Piaget, conservation is the central prerequisite for the subsequent development of logical thought. Conservation has been defined as the ability of the individual to be aware of the invariant properties of objects in the face of a perceptual transformation (Siegel and Hooper, 1968) and the child's level of conceptual development may be measured by determining his mastery of conservation. This ability, however, does not appear suddenly and a number of studies have supported Piaget's claim that conservation does indeed develop over time (Elkind, 1961). Many educators have been interested in the relationship between intelligence, mental age, academic achievement, and level of conservation ability. Miller (1970) found conservation to be strongly related to mental age, particularly with retarded children, while Kaminsky (1971) found a conceptual test of conservation to be highly correlated with arithmetic achievement in first graders. Since reading is a thinking process in which children must learn to attend to proper perceptual cues, Rausher (1971) hypothesized that reading readiness in kindergarten children would be strongly related to conservation development since successful conservation also depends upon the ability to attend to relevant perceptual data. This relationship was in fact found and children who demonstrated good conservation ability had higher reading readiness scores than those who showed poorer ability. The purpose of the present study was to replicate Rausher's method in an effort to determine whether success in reading achievement at a later grade level would also be related to the child's ability to conserve. It was hypothesized that children who demonstrated poor reading ability were attending to improper perceptual cues and that this would be reflected in their poorer conservation performance; they would in fact be arrested at an earlier level of development. If this were true, this relationship might have significant educational implications since new methods of teaching reading might be more effective if they considered the child's level of conceptual development.

Method

Subjects. Thirty-six second grade children from a parochial school in Camarillo, California were individually given both a reading achievement test and a test designed to measure the level of their conservation development.

Task and Administration. The reading subtest of the Wide Range Achievement Test (WRAT) was the measure of reading achievement (RA). The conservation tasks were modeled after Rausher and included one task of conservation of mass, two of conservation of length and two of continuous quantity.[2] The answers to the conservation measures were recorded verbatim with scoring computed later. Subjects were scored blindly; the experimenters did not know which children were poor readers and which children were good readers when they computed the conservation scores.

Analysis. Since the study was conducted at the end of the school year, a WRAT score equal to or above 3.0 was used as the cut-off point in ascertaining RA. Following Rausher, the child was considered to have achieved an adequate grasp of conservation if he appropriately answered 3 of 5 conservation measures and was able to explain his answers adequately. A chi square statistic was then utilized to determine the relationship between RA and conservation ability (Bruning and Kintz, 1968).

Results

The scores for reading achievement and conservation are shown in Table 1. The relationship between RA and attainment of conservation (C) was insignificant ($x^2 = 1.66$, $p > .05$). Only seven children scored below grade level in reading. Of those, three were conservers and four were nonconservers. Of the remaining twenty-nine children who scored at or above grade level in reading, twenty were conservers and nine were nonconservers. These tabulations are shown in Table 2. The mean reading score for the class was 4.3.

[1] For a thorough presentation of the experimental studies focusing on Piaget's concept of conservation see Siegel and Hooper, *Logical Thinking in Children.*

[2] For a description of these see Appendix A.

APPENDIX B
TABLES

TABLE I
READING ACHIEVEMENT AND CONSERVATION SCORES

Subject #	WRAT Reading Grade	Conservation Total Score	Subject #	WRAT Reading Grade	Conservation Total Score
1.	7.0	3	21.	4.1	2
2.	2.8	2	22.	3.3	3
3.	4.7	5	23.	4.8	4
4.	4.2	5	24.	4.1	3
5.	2.3	5	25.	2.8	4
6.	3.5	4	26.	4.8	1
7.	2.5	0	27.	2.2	3
8.	4.7	1	28.	3.6	3
9.	2.1	0	29.	4.4	3
10.	5.9	2	30.	4.4	1
11.	3.1	5	31.	5.0	5
12.	4.4	0	32.	3.9	1
13.	9.0	4	33.	4.8	5
14.	5.5	5	34.	5.9	5
15.	4.8	5	35.	4.2	5
16.	2.6	3	36.	3.6	2
17.	4.7	5			
18.	5.1	4			
19.	5.1	4			
20.	3.9	2			

TABLE II
FREQUENCY COUNT FOR LEVELS OF READING ACHIEVEMENT AND CONSERVATION

		Attainment of Conservation	
		conservers	nonconservers
Reading Achievement	below grade level	3	4
	on or above grade level	20	9

Discussion

The relationship between RA and C that Rausher found in the early school age child was not demonstrated with second graders. This finding supports Almy (1966) who found that as conservation ability became more widespread, its relationship to RA decreased. The results of the present study, however, may have been clouded by the high reading level of the experimental population. Overall reading performance was well above grade level and of the seven children classed as poor readers, none were behind more than half a year in reading achievement. Thus, the distinction made between good readers and poor readers may have been an artificial one and differences in conservation ability may have been the result of other unconsidered factors.

When a real difference between readers exists the relationship may indeed show up. Further study with a larger population perhaps comparing the performance of a classroom of average children with the performance of truly poor readers is necessary before any firm conclusions may be drawn.

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Multiple Classification, Class Inclusion and Reading Ability

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Piaget's theory of mental development suggests that qualitative differences may exist in the thinking processes of children who read well as compared to those who read poorly. This study investigated relationships existing between reading achievement (as exhibited on group administered, pencil-paper tests) and the acquisition of two Piagetian operations, e.g. multiple classification and class inclusion (as exhibited on individually administered, card sorting tasks). The two cognitive operations, multiple classification and class inclusion, were selected for testing because the investigator believed that the ability to deal with part-whole relationships within a set of categories, especially shifting categories, is important for efficient reading. It was hypothesized that a delay in the acquisition of the two identified operations would present difficulty in the abstraction of the basic structural generalizations which underlie English orthography. Thus poor readers might be children who use preoperational tools of thought beyond the chronological time when the logic of classes should have developed.

Fifty-six children were randomly selected from the second (N=27) and fourth grades (N=29) of a public elementary school located in Natick, Massachusetts. To assess reading achievement, the Ginn Second Grade Readiness Test was administered to second graders and the Iowa Silent Reading Test (vocabulary and comprehension subtests only) assessed the fourth grade students. To measure the attainment of the multiple classification operation, the Free Sorting Classification Task was given to all of the subjects. Only 20 children in the second grade were assessed as to attainment of the class inclusion operation (the structured sorting classification task was utilized). Therefore, generalizations as to the relationship between reading achievement and class inclusion can be interpreted only for second graders and must be tentative at best.

The results of the study made the following conclusions possible, given the limitations of the testing criteria and the size of the sample:

1) Good readers tend to have the multiple classification (N=56) and class inclusion (N=20) operations.

2) Reading ability and multiple classification tend to be related, independent of C.A.

3) Reading comprehension and multiple classification (N=51) tend to be related, independent of I.Q.

4) Reading vocabulary and multiple classification (N=51) are not related, independent of I.Q.

5) Reading ability and class inclusion (N=20) tend to be related, independent of I.Q.

The results indicate that good classifiers tend to be good readers and that poor readers tend to be preoperational. Therefore, the study indicates that a child having problems grouping pictures according to varying criteria or dealing with part-whole relationships might have difficulty classifying the letter-sound generalizations necessary for efficient reading.

A Psychometric Approach to Piaget: Some Theoretical and Methodological Implications

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The construction of scales based upon Piaget's theory has gained considerable support from various groups of professionals (Pinard & Laurendeau, 1964; Sullivan, 1967; Woodward, 1963). Piaget himself once expressed such an interest (Piaget & Inhelder, 1947) though he has left the task of test construction to others. The central theme underlying this movement is the argument that currently used intelligence tests have fulfilled statistical but not logical criteria for a "good" test. Moreover, Binet and Wechsler type tests have been challenged on the following grounds: a) they measure outcomes rather than processes, b) they are biased in sample content and in norming with only white middle class children (Williams, 1971), and c) their difficulty levels are established on statistical bases, not inherent difficulty. The marketed intelligence tests are merely attempting to discriminate among children at various ages, using items chosen for their ability to do so. A more acceptable approach to mental testing is one whose items are selected on the basis of a genuine theory of cognitive development. Piaget's theory offers just such a possibility.

In an address presented to this conference last year, Meyers (1972) posed the following question: Can Piaget's theory provide a better psychometry? Although some optimism was suggested for limited scales, a set of problems was forwarded which could ultimately question the validity of scales based on Piaget's theory. It is the purpose of this paper to discuss those theoretical and methodological questions in more detail with the intent of cautioning interested professionals to the issues of applying psychometric principles to Piagetian theory in the hopes of producing useful and valid scales.

The first step in constructing scales based on a theory is to determine whether the theory is a valid one; that is, internally consistent and amenable to testing. Innumerable studies have replicated many of Piaget's stages and demonstrations showing them to be in true ordinal relationship to one another for various groups of children, including the developmentally disabled (Inhelder, 1968; Reiss, 1968; Yoshida, 1973). A wide range of ages mark the onset of different operational behaviors but the order of their appearance remains invariant. The stages of tasks such as conservation items of the Goldschmid-Bentler (1968) variety form in most cases a Guttman scale which is sensitive to the hierarchical sequence of items in which the most difficult item succeeds the easier ones and so on. In short, we have a tentative validation of the theory.

The test development work, like most Piagetian research, thus far has almost exclusively employed cross sectional designs. The usual procedure selects subjects according to age, then noting whether their responses form a Guttman scale. This procedure has the usual drawbacks of a cross-sectional study, namely that we are not completely sure that individual children follow a particular pattern of development over the long-term, particularly whether they demonstrate an order that deviates from the hypothesized sequence of development. In other words, order found by cross-sectional techniques will always be tentative. A longitudinal study must be conducted to insure the validity of the hypothesized order.

We have knowledge of two longitudinal efforts. One project by Almy and others (1966) confirmed that conservation of number precedes that of continuous quantity or liquid conservation as was found in replication studies. An ongoing project by Stephens at Temple University using normal and mentally retarded subjects (Stephens, McLaughlin, & Mahaney, 1971) has yet to publish complete findings on the order of stage development. Their preliminary data appear to indicate correspondence with Piaget's findings. Though narrow in domains examined, longitudinal studies have resulted in a qualified validation of Piaget's stages.

Finding general validation does not give us sufficient reason to accept Piaget as an alternative to the current measures. We must also ascertain whether Piagetian tasks measure a construct different from those sampled by present tests or do better in the measurement of what is intended to be measured. Kaufman (1971) factor analyzed a test battery consisting of the Lorge-Thorndike Intelligence test, Gesell School Readiness test and a Piagetian battery composed of some conservation, class inclusion, logic and geometric problems to a group of elementary school children. Each test loaded on separate factors, demonstrating the relative independence of Piagetian tasks from the content of other psychometric instruments. Meyers and Orpet (1971) found with 5½ year olds that their selected conservation tasks did not load on a single factor but were factorially complex. Although some of the tasks loaded on factors containing some WPPSI, Raven and ITPA subtests, there was a high degree of specificity for the Piagetian tasks in relationship to the various psychometric instruments. Finally, correlations of Piagetian tasks with MA, IQ, and the subtests of the WISC are generally low, rarely exceeding .50 (Dodwell, 1961; Elkind, 1961; Goldschmid, 1967); the highest r's, +.52-+.62, were obtained by Dudek, Lester, Goldberg, and Dyer (1969). Even with an MA range of 2½ to 8 years in

trainable mentally retarded subjects, Yoshida (1973) found Kendall tau coefficients of only +.32 or lower between Binet MA and Guttman scale scores of Piaget-Inhelder haptic perception tasks. Thus, Piagetian tasks may tap aspects of a construct of intelligence which are quite different from those sampled by the WISC and other psychometric instruments.

Thus far we have developed two conclusions. One, the Piagetian scales have been shown to follow the general sequence hypothesized by Piaget and his co-workers over different test situations and subjects. Two, they are substantially independent of the constructs measured by traditional instruments. Considering these findings, we have strengthened the rationale for building standardized Piagetian scales which may be used in conjunction with or eventually replace the Binet and its derivatives.

Assuming that we accept Piagetian theory as our standard of development, what are the problems encountered in constructing a useful test or battery or tests? First of all, Piaget's theory spans a large section of time analyzing levels of development in various concepts. We have to contend with time and content dimensions which may not be readily reduced into one scale. Secondly, we are well aware of the published protocols of Piaget and his colleagues in which the investigator interacts with his subject. The obvious difficulty is extracting those aspects of Piaget's questioning technique which are modifiable for easy wording and in a more important sense, standardization. Not to be ignored are the many ways within demonstrations such as class inclusion which were varied by Piaget to determine the qualitative aspects of growth. What variations in materials would make for the most valid diagnosis have yet to be determined. As a result, we have an enormous albeit rich corpus of materials and methods from which to select our test items. If we reduce this body for the sake of efficiency and standardization as a psychometric approach would necessitate, would we be compromising the validity of our final product? What follows is a discussion centering on the issues of inclusiveness of tests, the method of questioning and the complexity of test materials based on Piaget's theory.

Let us begin with the issue of inclusiveness. Piaget's mental development theory encompasses a fairly large chronological age range of a typical child's life. Certain classes of behaviors and mental structures have been hypothesized for neonates through adolescents. Although the development of infant scales by Uzgiris and Hunt (1968) and Escalona and Corman (1967) are of extreme importance, they will not be typically employed in the school setting. We need to concentrate on processes beginning at two years and culminating with the higher levels of formal operational thinking. What we are talking about is a test which samples behavior from 2 to 18 years.

The most extensively reported prototype of such a general scale is the one devised by Pinard and Laurendeau (1964) comprising of 57 subtests beginning with items from the preoperational stage and extending to the formal operations stage. Twenty-five subtests were directly taken from Piaget's work in the areas of causality, time, movement, speed, relations, number, space and conservation. The attempt by the constructors to devise a comprehensive scale across most stages and content domains reveals the extreme caution taken to insure proper placement of the examinee on a general scale of development. Altogether the test required 10 hours on the average to administer and was divided into four to six sessions depending on the child's age. Use of the clinical method may explain in part the prohibitive amount of time taken to administer the battery. Nevertheless, the sheer number of tasks contributed to most of the time involved.

The above effort exemplifies the possible breadth of a Piagetian test battery. Our goal is to assess a child in relation to an operational level, not limiting ourselves to a certain type of demonstration. Published or quasi-formal Piagetian test instruments are quite limited in scope. For example, the Goldschmid-Bentler Conservation Assessment Kit taps only conservation of some of the more popular tasks such as substance, weight, liquid, number and so on. Processes such as seriation and transitivity and other tasks drawn from the concrete operational stage are not sampled. Accordingly, the test inadequately assesses children who have reached this level of thinking and the generality of results are restricted to conservation only.

What we are saying is that conservation is only a partial sampling of the concrete operational stage. By limiting the test to only conservation as an example, we may make judgments to specific content areas without more precisely pinpointing development of a more general nature. That is, can children who correctly solve conservation problems also respond operationally to class inclusion problems which have been hypothesized to be at the same level of development?

In general, Piagetian demonstrations load on separate factors and produce low intercorrelations among themselves. Lunzar (1970) sampling the conservation, classification, logic and spatial domains found that those Piagetian tasks yielded four factors. The largest factor in terms of variance accounted for loaded with most of the items from the battery. However, the other three factors, classification, spatial and what Lunzar termed a verbal factor comprised 40% of the total variance, demonstrating the diversity of the abilities sampled. Kaufman also found separate factors from his battery of Piagetian tasks. Another innovative experimenter, Tuddenham of the University of California, Berkeley (1971) found low intercorrelations among his tasks. Unreliability was ruled out as a possible explanation for such a diffuse

correlation matrix. Similarly, Goldschmid and MacFarlane (1968) found correlations on the order of +.25 between scores from Form A of the Conservation Assessment Kit with tests of probability, seriation, classification and perspective. With the exception of the latter investigators, specificity of tasks was forwarded as the probable cause for the above results.

The four studies indicate that although we are dealing with a single course of development, specific operations are manifested noncorrespondingly across the different content areas. In order to accurately and validly assess growth of the total operational system, we must sample a wide variety of tasks.

Our second point of controversy concerns Piaget's use of the clinical method to probe the child's ability to understand a task. Briefly, Piagetian tasks are presented in the following manner:

a) Language check is made before commencing the demonstration or judgment to this effect during testing.

b) Agreement to the properties of the tasks such as in a classification task that all the beads are wooden, their colors and other properties as size are the same.

c) Establishment of equivalence if necessary as in a typical conservation problem as liquid in which water is at the same level in all beakers.

d) Perceptual transformation of the objects or some change in the presented situation.

e) Judgment question.

f) Explanation questions.

The first five steps are dispensed with rather quickly. However, the child must explain his judgment answer. A Piagetian process does not merely ask a question to a given problem, recording the responses as right or wrong. It probes into how the child reached his conclusion or judgment by challenging and countersuggesting to determine whether the answer was contrived given this response "my teacher told me so," perceptually oriented as "they both look the same," or a true mastery of the concept.

What we have here is the desire to increase confidence in assessment. The distinction is often made between appraising what a child does given standard objective questions in contrast to what he can be brought to do with the appropriate probing of the clinical method. This procedure unsheaths a two-edged sword. On the one hand, we could disuade a child who is unsure of his answer. We could uncover the fact that his schema is not completely intact. On the other hand, we might tease out of a youngster an acceptable conceptual response after he unwittingly gave a nonoperational response as "we found out in science." Quite possibly he did but if he can adequately explain the concept we would change our conclusion to one of the subject thinking at a higher operational level.

The inclusion of the clinical method in test instruments has become an important issue. If the clinical method is drastically altered for the sake of convenience and efficiency or is eliminated entirely as some writers have suggested (Brainerd, 1973), are we really removing most of the characteristics of a valid Piagetian exploration as Inhelder, Bovet, Sinclair and Smock (1966) contend?

Quasi-clinical methods have been devised which standardize questioning but allow individual discretion in deviating from the set pattern (Lunzar, 1970; Tuddenham, 1971). Tuddenham in particular states that the clinical method *a la* Piaget was ideal for discovering qualitative differences in a child's thought and for formulating a theory of development. However, such a technique interferes with the presentation of materials under identical conditions which is [illegible] psychometric approach. Tuddenham argues that the groundwork for substantiating the theory has been completed and that for test purposes liberties may be taken with the *method clinique*. His modified version of the clinical method is in the spirit of Piagetian inquiry. He allows the child to explain his judgment. When ambiguity as to the nature of responses occur, standard questions are then administered to fit the individual case. Rigorous investigation must be conducted between results using the classical method and any of the alternative procedures before any one of them is accepted. We could thus have the best of both worlds.

Our third problem is that of task complexity of materials which may have specific effects on results. Feigenbaum (1963) varied the number of beads and the perceptual disparity between containers in a discontinuous quantity problem. In his experiment, 12 beads were presented in one condition and 24 in another. The physical size difference between the original glass containers and the one the beads were to be poured into was reduced to produce less perceptual distortion. The findings were somewhat mixed. The increased number of beads resulted in fewer conserving responses for children who were concluded to have incomplete operational structures. The size of the containers had no effect on the frequency of correct responses for the entire group of subjects. Goldschmid (1967) also reported differences in correct judgments with conservation of substance, continuous and discontinuous quantity when complexity of materials was manipulated. The above evidence suggests that constructing items may not be a simple undertaking. Attention must be given the variables affecting the item difficulty for each Piagetian task.

This paper has reviewed the basic rationale for developing tests based upon Piaget's mental theory. We have discussed the problems of inclusiveness, method of interaction with

the examinee and the complexity of tasks selected for inclusion on such a test. No doubt, the problems are formidable and possibly insurmountable. Test constructors are confronted with the predicament of preserving the consistency between theory and a test instrument while at the same time fulfilling the requirements of standardization, brevity and efficiency. These two approaches may not be compatible as one would wish. And the compromising of the two may not result in an acceptable measure to either Piagetian purists or those who desire a condensed testing instrument.

A parsimonious scale then by our view is almost out of the question. The restrictions due to time and the finding of separate content domains with stages preclude such a culmination. Rather limited scales testing individual functions will be more within reason. However, even that scenario may not be completed until issues such as "the exploration method," item difficulty of tasks and the order of item presentation are resolved. The path before is a formidable one; one that demands patience, suggestion and counter-suggestion to achieve our goal.

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A Study of the Relationship Between Gesell's Developmental Age and Piaget's Concept of Conservation

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INTRODUCTION

Schools are presently searching for better measurements of individual readiness for specific levels of instruction. For many years educators have used intelligence tests to provide measures for predicting school achievement and at times for class placement. During the last decade the Gesell Developmental Examination has also been used in some schools for class placement. Currently, Piagetian tasks are being widely examined for application to school situations. Of interest to educators would be studies examining the relationship between different indicators of child development. One such study is reported here.

Arnold Gesell, founder of the Gesell Institute of Child Development, and his staff have produced material over four decades which describes the theory of developmental, or behavioral, age; and the procedures for establishing their validity. Gesell postulated that behavior is patterned and develops in predictable stages (Gesell and Amatruda, 1945, 173-194) or "degrees of maturity." (Gesell and Ilg, 1946, 19-20). Although no two individuals are exactly alike, all normal children tend to follow a general ground plan which is characteristic of the species and the cultural group. (Gesell and Ilg, 1943, 72). The general course of development is similar for boys and girls although girls mature somewhat more rapidly and earlier. (Gesell and Ilg, 1946, 19-20)

Over a period of forty years, Gesell and his staff minutely observed and recorded on film the behavior of hundreds of children as they grew from infancy to 5, 10, 16 years of age. From these observations, normative patterns of behavior were charted and described, and tests were selected which defined the developmental ages for children. (Gesell, *et al*, 1940; and Gesell and Ilg, 1946) These tests used primarily at the clinic were later revised and standardized for school use by Ilg, Ames and Appel. (Ilg, Ames, and Apell, 1965, 62-91) Now known as the Gesell Developmental Examination, it is a battery of graded behavioral tests comprising primarily eye-hand coordination and verbal tests. It is administered to an individual child by a trained examiner. Scores are expressed in terms of developmental ages based upon sequential characteristic behaviors for each test. (Ilg and Ames, 1964)

Jean Piaget, of Switzerland, is currently recognized as one of the most important development psychologists. From about 1940 onwards, his clinical techniques and observations of children have led him to generate an extensive theory of mental development. His research is important to educators because he has shown that the relationship between experience and mental development is a crucial aspect in the total development of the child.

Piaget describes mental growth as proceeding in an invariant order of stages which he has named the sensory-motor, pre-operational, concrete operational, and formal operational stage. (Flavell, 1963, 164-236) He has theorized that stage-progression is dependent upon the interaction of maturation, experience, social transmission, and equilibration which sets the limits and determines the character of what can be learned during that stage. (Almy, 1966, 20-22; and Duckworth, 1964, 172-175) To determine the stage at which a child is functioning, Piaget has noted the mental problems the child is able to solve and the mode of thinking that he uses. The problems of conservation, for example, have come to be a landmark in his theory. For Piaget, the attainment of such ability marks the transition from the predominantly intuitive thought of the pre-operational stage to the more logical thought of the concrete operational stage. (Sigel and Hooper, 1968, 3)

In conservation tasks, an individual child is presented with two different but equal quantities of material (two balls of clay, two glasses filled with liquid) and is asked whether the two have the same amount. After the child agrees that this is the case, one of the quantities is transformed (a clay ball is rolled into a sausage, a glass of water if poured into a taller thin glass) and the child is asked again whether the two have the same amount. (Piaget, 1965, 243) Responses are based upon an understanding of the constancy of the material.

Piaget's results indicated that the child's ability to conserve is arrived at gradually, and that a period of non-conservation is followed by a transitionary period of perceptual domination, finally progressing to a complete stage of conservation. (Almy, 1966, 34)

The Research Problem

The study reported here was designed to determine if there was a significant correlation between developmental age and the concept of conservation. To obtain the data needed, thirty primary children from one elementary school were randomly selected and tested with six Piagetian conservation tasks and the Gesell Developmental Examination. The data were collected in April and May 1971. Raw scores for both sets of data were transmuted into ordinal data and statistically compared using rank-order correlational procedures and the test of significance.

The Research Hypothesis

The hypothesis was that if developmental age and the concept of conservation are related, then stages of understanding

conservation will increase as developmental age increases.

PROCEDURES

Population

This study was made in Fullerton, a suburban community located in Orange County, California. The Fullerton Elementary School District operated seventeen elementary schools, grades kindergarten through sixth. For three years previous to the study, the primary children at four of these schools were being placed in developmental levels based upon the results of the Gesell Developmental Examination. These levels were arranged sequentially to include the young pre-kindergarten group (4½ Gesell level), kindergarten (5 Gesell level), pre-first (5½ Gesell level), first (6 Gesell level), pre-second (6½ Gesell level), and the second (7 Gesell level) grades.

Sample

Thirty children for this study came from one of these Gesell-Developmental-Placement-Schools, Rolling Hills School, which had approximately 203 students placed in the Gesell levels 4½ to 6½, on the basis of the Gesell Examination from the previous Spring. The sample consisted of sixteen boys and fourteen girls: five from pre-kindergarten, eight from kindergarten, six from pre-first, seven from first, and four from pre-second. Their chronological age range was 5[9] to 8[0].

Methodology

The interview technique on a one-to-one basis was used for both Piagetian conservation tasks and the Gesell Developmental Examination. Conservation tasks were administered by the investigator during April 1971. Gesell Developmental Examinations were administered by one of the six trained teacher-examiners in May 1971.

For the conservation tasks, the investigator chose to replicate tasks described in the literature. In each task, the same procedure was used: the subject was given a brief training to establish familiarity with the material and to develop an understanding of the vocabulary. Then, three transformations of the material were made. Initial equivalence was re-established between each transformation. The subject was asked to quantify the material as being "more" or "the same" and to respond to the question, "Why do you think so?" or "How can you tell?" after each transformation. Responses were evaluated as "conserving" if the explanation met one of the three criteria established by Piaget: (1) the material had only been lengthened or shortened and could be restored to its original shape; (2) the material had been modified but what if had lost in one dimension it had gained in another; or (3) nothing had been added or taken away. (Piaget, 1957, 16) Responses were considered "non-conserving" if the explanations did not meet one of these criterion. No attempt was made to score responses as transitionary. Each conservation response was scored one and all non-conservation responses were scored zero. The total possible score was eighteen.

The six tasks chosen were centered around the child's concept of conservation of quantity. The term "quantity" is a generic term for materials which can be treated globally and compared in terms of amount. Subclasses of quantity are considered "substance," material massed by nature such as plasticene; "discontinuous quantity," material usually handled in separate parts but which can be massed such as beads; and "continuous quantity," liquid material such as water. (Piaget, 1965, 25-38) The three quantities were presented, first by using one set of tasks and then repeated through a second set of tasks as follows: (1) discontinuous quantity using beads (Piaget, 1960, 25-38); (2) substance using Play-Dough (Elkind, 1968, 11-18); (3) continuous quantity using water (Piaget, 1960, 4-14; and Almy, 1966, 53-54; (4) discontinuous quantity using blocks (Almy, 1966, 51-54); (5) substance using plasticene (Sigen and Hooper, 1968, 19-38); and (6) continuous quantity using orangeade. (Piaget, 1960, 4-14; and Almy, 1966, 53-54)

The six tasks were tried out in a pilot of study of fifteen children from the same student population as used in the sample. Each subject was seen individually between 8:30 and 11:30 A.M. in a private room. The time for complete testing varied from fifteen to twenty minutes.

For the Gesell Developmental data collection, each subject was seen individually in a private setting. The time for complete testing varied from 30 - 45 minutes. A fixed order of presentation was used as described by Ilg and Ames: initial interview, paper and pencil tests, right and left tests, form tests, naming of animals, concluding interview, and examination of teething progression. Subject's responses were recorded verbatim and later evaluated by the norms established by the Gesell Institute. (Ilg and Ames, 1968, 31-240). Reliability coefficients were not given by the authors.

The developmental scores on each of the tests were transmuted into ordinal data based upon an arbitrary point system from zero to eight as follows: zero points for each response below four-and-one-half; one point for each 4½-response; two points for each 5-response; three points for each 5½-response; four points for each 6-response; six points for each 7-response; and eight points for each 8-response. The scoring sheet devised by the investigator (Figure 1) shows a contingency table whereby the tests are also given quantitative values. The greatest amount of weight was given to the paper and pencil tests including the incomplete man, the right and left tests, and the form tests because these sub-verbal tests were most significant in the total developmental evaluation by Ilg and Ames. (1964, 34). A total of 320 points was possible.

DATA ANALYSIS

The Spearman Rank-Order Correlation Coefficient and a rank-order correlation coefficient for tied ranks were used

to determine the relationship between the developmental scores and the conservation scores. Table I gives a tabular presentation of the data. The Spearman Correlation Coefficient (rho) yielded a value of .555. A correction formula for tied ranks yielded a rho of .549. For the test of significance the lower correlation coefficient of .55 was used and found to be significant at the one-percent level.

Summary

On the basis of the results derived from the rank-order correlation between the developmental scores and the conservation scores, it may be summarized that a relatively high relationship existed between the two variables which was significant at the one-percent level.

DISCUSSION

Implications and Recommendations

1. While the obtained correlation of .55 was strongly positive, it could not be considered high enough to use for predictive purposes between the two instruments. That is, conservation scores would not be used to predict developmental scores and visa versa.

2. It would seem that the Gesell Developmental Examination still appears to be a valid means of determining readiness for developmental levels of learning since it provides not only a cognitive rating, but also indicates the child's total development as suggested by Gesell, Ilg, and Ames.

3. Implicit in Piaget's theory of stage progression is the interaction of maturation, experience, social transmission, and equilibration. If a child does depend upon this interaction to gradually move from a non-conserving stage to a transitionary stage and finally to a conserving stage, then perhaps conservation scores could likewise be used for successful school placement since they, too, would seem to represent the total development of the child. This should be a consideration for future research.

4. If both instruments are considered important to educators, then it would seem that both should be used together until such time as one or the other is proven to be the better predictor of school achievement.

5. It is recommended that the curriculum for primary children even in a developmental-placement school be highly individualized. Although the results of this study gives evidence that there is a trend for children to develop conservation understanding as their developmental age increases, there were some children (EE, Q, I, S, AA) who demonstrated an inconsistent pattern. An assessment of individual readiness for sequential learning tasks within each developmental level continues to be an important consideration to educators.

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A Comparison of Wechsler IQs and Piaget Levels in Children

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INTRODUCTION

In 1963 I became involved with Piaget theories of stages in moral and cognitive development in an attempt to evaluate ancient Judaic teachings and practices regarding life cycle rites or passage, in the light of contemporary psychological insights.

About 2000 years ago, Samuel The Younger (Goldin, 1962) taught that a child at five years of age was ready for the study of Holy Scriptures, which historically represent the logical and social egocentric stage in the literary historical development of the early Hebrews. I found this to be a good fit with Piaget's concept of preschool egocentric thinking, where the child is unable to conceive of the perceptual world in terms of impersonal, abstract and reality-oriented concepts. In the Holy Scriptures, Moses indeed talks with God at the top of the mountain, and the Jews listen in.

At the age of ten, Samuel The Younger instructs the child to begin the formal study of the Mishnah, the six books which codify and order the mass of written and oral ancient Judaic laws into a topical and logical series of legal, domestic, agricultural, commercial and physiological sections. Again this represents a neat fit with Piaget's general age range of seven to ten years, when the child becomes capable of conservation of substance and of weight, and where level of cognition includes logical operations of class inclusion, and of serial ordering respectively. The child can take simultaneous cognizance of two (or more) variables, and he can order objects (or their properties) in series.

At the age of thirteen, according to Samuel The Younger, the child was fit for "fulfilling the commandments." This age became the occasion, through the centuries and to this very day, of a major Jewish rite of passage – Bar Mitzvah, "Son of the Commandment" – celebrated with pomp and ceremony, and scarcely less important to the Jewish family and to Jewish religious institutions than a birth or wedding. Much controversy surrounds the origin of fixing this rite at age thirteen. Although Theodor Reik (1964) attributed the origins of Bar Mitzvah to repressed initiation puberty rituals, which at one time supposedly inducted the male child into the warrior status, the Old Testament clearly indicates twenty years of age as the age of conscription to military service. There is, on the other hand, clear evidence that the elders of ancient Israel had established the age of thirteen as the age of religious and intellectual maturity, and had assumed that the growing child had reached the stage of accepting responsibility for making moral and ethical decisions, and of being held personally accountable for wrong doings. Ancient scriptures describe children within the age range of twelve to fourteen, (a neat fit with Piaget's stage of formal or propositional operations) who were intellectual protagonists for their elders.[1]

Having been involved for many years in the religious instruction of Jewish boys preparing for Bar Mitzvah, from the age of nine years and older, this thought had long before interested me: Why did the elders fix a rigid point of thirteen years of age for Bar Mitzvah? Why did they not take into account individual differences, and permit younger but brighter children to be Bar Mitzvah at an earlier age. And once I had begun to see a relationship between Samuel The Younger's "Ages of Man," and Piaget's stages of cognitive development, I became intrigued with the idea of testing one hypothesis in particular, i.e. that nine and ten year old Jewish boys, of superior and very superior IQ ranges, would indeed demonstrate the acquisition of the level of conservation of volume, one to two years before the age assigned by Piaget to the emergence of these logical operations. And thus this study emerged.

GENERAL PURPOSE OF THE STUDY

The general purpose of the study was to examine the relationship between the Piaget levels of conservation and Wechsler IQs. Interest was focused on the possibility of making predictions about performance from one test to the other. Since both tests measure intellectual functioning they would be expected to have certain cognitive elements in common; Cronback (1960) in his brief reference to Piaget's work, indeed makes this kind of specific prediction. In particular, since in Piaget's theory specific levels of cognitive development appear within defined age ranges, the present study sought to establish whether or not a high performance on the Wechsler (above normal) would be paralleled by a high performance on the Piaget, i.e. transcending the expected level for this age. Since, according to Piaget, the notions of conservation in their development appear to be relatively uninfluenced by academic and verbal experiences (Inhelder, 1943), it was also assumed that a stronger relation-

[1] Jerome Kagan (1973) failed to grasp the significance of the early Hebraic understanding of age-appropriate levels of learning. He refers to the ancient Hebrew practice of ranking children on their ability to recite long passages from the Old Testament, but missed the point entirely, that this was the criterion of intellectual rank for children *five to nine years* of age.

ship would obtain between notions of conservation and the performance scale of the Wechsler, than between the former and the verbal scale.

This study thus represented a replication of Piaget's findings with respect to a particular stage of cognitive development, while at the same time relating them to another measure of cognitive functioning, the WISC. The particular age group selected represented the age between 9 years 0 months to 10 years 4 months. Both technical and theoretical considerations were involved in this choice. From a technical standpoint this was an age range in which subjects would be readily available and expected to show high interest and motivation. Theoretically, not only would the basic proposition that this age group would achieve the level of conservation of weight be tested, but, by varying the sample along a continuum of IQ, allowance would be made for the possibility that some subjects (o.e. in the superior IQ ranges) would perform at the highest level of conservation.

HYPOTHESES

The following hypotheses were advanced:

1. That a significant and positive correlation would be found between WISC Full Scale IQ scores and Piaget scores.
2. That a higher correlation would be found between Piaget scores and WISC Performance IQs than between Piaget scores and WISC Verbal IQs.
3. That nine to ten year old subjects of average and bright normal IQ ranges would demonstrate the acquisition of the understanding of concepts of conservation of substance and weight, but not of volume.
4. That nine to ten year old subjects of superior and very superior IQ ranges would demonstrate the acquisition of the level of volume in addition to those of substance and weight.

METHOD

Forty boys, within the age range of 9 years 0 months to 10 years 4 months were assigned to four groups differentiated on the basis of the following Wechsler intelligence classifications: average, bright normal, superior, and very superior. Subjects for each of the IQ ranges were selected on the basis of the following four WISC subtests: Vocabulary, Information, Comprehension and Arithmetic.

The subjects were screened for gross emotional, physical or neurological disorders, and all attended their appropriate grade levels. All were residents of West Los Angeles from middle to upper class Jewish homes who attend private parochial school twice a week in addition to regular Los Angeles elementary schools.

Each subject was first given the WISC; during a second interview following a 15 minute recess, the Piaget test was administered, the examiner eliciting in a directive but supportive manner the subject's notions concerning the principles of conservation of substance, weight and volume, as well as his ability to adapt his thinking, if incorrect, to experimental facts as presented to him. The Piaget test consisted of three subtests:

1. In the first, or Clay test, the subject indicated whether or not he believed that a clay ball, deformed in various ways, or broken into small pieces, would retain (in terms of a comparison with another identical clay ball) its original quantity, weight, and volume.
2. In the sugar test, the subject was asked what would happen to a sugar tablet dissolved in water, whether it would disappear entirely or would remain somehow; whether the increment of weight due to the addition of sugar would remain after its dissolution; and whether the level of water that rises when the sugar is added will return to its original stage as the sugar dissolved.
3. In the bars-cylinders test the subject's ability was investigated to determine if he could deduce weight equivalence of homogeneous elements as well as heterogeneous elements; and volume equivalence of these same varied elements, plus additional materials such as different weights and lengths of cylinders.

A scoring method was devised to reflect three main types of performance on the Piaget tests: (a) a lack of notions of conservation with inability to profit from experimental verification; (b) a spontaneous demonstration of notions of conservation; and (c) initial failure followed by modified responses in the light of corrective experience.

The highest subtest Piaget score represented the highest level of achievement for each subject. An additional scorer scored the data obtained to insure reliability of the scores. It was demonstrated that the three subtests intercorrelated while the overall reliability of the tests (.788) was determined by use of the Kuder-Richardson formula for estimating reliability.

RESULTS

The following table presents the correl tions found between Piaget scores and WISC IQs:

WISC Scores	*Piaget Scr* r	p	*Clay Test* r	p	*Sugar Test* r	p	*Bars-Cylnd* r	p
Full Scale IQ	.141		.374	<.05	.305		.171	
Verbal Scale IQ	.020		.290		.225		.037	
Performance Scale IQ	.272		.391	<.05	.333	<.05	.308	
Verbal Subtests								
Information	.037		.179		.259		.051	
Comprehension	-.090		.060		.009		-.085	
Arithmetic	.003		.171		.237		-.003	
Similarities	.124		.492	<.01	.178		.133	
Vocabulary	.001		.135		.163		.041	
Performance								
Picture Completion	.165		.506	<.01	.131		.177	
Picture Arrangement	-.104		.110		-.025		-.038	
Block Design	.390	<.05	.203		.498	<.01	.360	<.05
Object Assembly	.384	<.05	-.002		.398	<.05	.375	<.05
Coding	.067		.241		.098		.117	
Piaget Tests								
Piaget Raw Score	1.000*		.404	<.01	.825	<.01	.971	<.01
Clay Test	.404	<.01	1.000*		.435	<.01	.373	<.05
Sugar Test	.825	<.01	.435	<.01	1.000*		.787	<.01
Bars-Cylinders Test	.971	<.01	.373	<.05	.787	<.01	1.000*	

* r = 1.00 represents the self-correlation for the test indicated.

The results showed that:

1. Although a negligible correlation was found between WISC Full Scale IQs and Piaget scores (.141), a correlation of .374 (significant at the .05 level of confidence) was obtained between WISC Full Scale IQ and the Piaget Clay subtest.

2. Although negligible correlations were found between Piaget and WISC Performance Scale IQ as well as between Piaget and WISC Verbal Scale IQ, the expectation of a higher correlation between Piaget and the Performance Scale appeared to be confirmed when the correlations between Performance Scale IQ and the Piaget Clay and Sugar subtests were considered (.391 and .333 respectively; significant at the .05 level of confidence). The Performance subtests which contributed mostly towards the variance were Picture Completion, Block Design and Object Assembly.

Correlations between each Piaget score and the WISC Verbal Scale IQs were low and nonsignificant. The only verbal subtest which appeared to have a significant relationship with the Piaget was the Similarities test.

3. The prediction that the average and bright normal IQ ranges would demonstrate the acquisition of substance and weight, but not of volume, was confirmed.

4. The prediction that the superior and very superior IQ ranges would demonstrate the acquisition of the level of volume was not confirmed.

Thirty-three of the 40 subjects, 82.5 per cent of the total sample, demonstrated the acquisition of the concept of weight on the three Piaget tests. Of the remaining seven subjects who demonstrated the acquisition of the level of volume, in addition to those of substance and weight, only 2 subjects in each of the superior and very superior IQ categories attained this level. One of the seven was in the average category, and 2 were in the bright normal range.

CONCLUSIONS

The results indicated that the two tests tap restricted ranges of cognitive functioning in common, mostly in the abstractive areas. This may express the fact that while the Wechsler is a strong measure of verbal (and culturally determined) intellectua' achievements, the Piaget is more closely related to developmental, epigenetic forms of cognitive behavior which result from the interaction between maturational processes and environmental influences.

The evidence in this study indicated that very superior and superior subjects in terms of WISC IQs are not able to transcend their age-appropriate Piaget level. This supports Piaget's contention that the development of reasoning abilities is relatively free from specific scholastic influences. In this regard it is noteworthy to quote Inhelder, who, discussing the various factors affecting people's reactions to the Piaget tests, states:

> If we nevertheless obtain in the face of this diversity of conduct a common mode of reasoning, then it is our choice of tests, no less than of method, which permits us to isolate the functional nucleus of thought from the array of other mental manifestations. The conservation problems highlight the functioning of intelligence independently of contingencies deriving from the verbal and memory acquisitions or in particular from scholastic training (1943, p. 266).

It may thus be plausible to interpret the obtained correlations between Piaget and Verbal and Performance scores as indicating that the Piaget test, in comparison with conventional tests, is relatively free from verbal and scholastic influences.

It is thus plausible to explain the failure of higher IQ levels to be differentially correlated with the Piaget in terms of the fact that we are dealing with two measures, both involving cognitive operations, but nevertheless embodying certain basic differences. While Piaget (theoretically and apparently empirically) involves different (or additional) mental operations between one stage and the next, this is not the case with the Wechsler. The WISC lacks a theoretical rationale and its standardization and statistical derivation of IQs is predicated on higher IQs resulting from either more efficient functioning and/or a higher level of performance on tests of the same basic nature, e.g., it can readily be seen that a higher score on the WISC can be obtained by answering a few more items on some or all of the subtests.

Since the sample in this study uses only one Piaget level age range which is relevant to the development of notions of weight conservation, there is no way of predicting whether the lack of a significant relationship between Piaget and the WISC Full Scale will hold over the entire range of cognitive development. Further investigations are needed of all ranges of IQ as they are related to the various chronological Piaget stages.

In general, since Piaget's tests of conservation represent points of integration of the child's experiences and knowledge into concrete and logical levels, and since these successive integrations or logical groupings may represent basic mental structures which underlie and mediate the child's approach to everyday problems and situations, Piaget's method promises to provide a natural ordinal scale of intelligence with a far greater degree of generalization than is possible with conventional scales of intelligence. As Hunt (1961) points out, such a scale could lend needed precision to the description of variations among the thought processes of children and adolescents. Moreover, by correlating each stage with educational and occupational accomplishments, i.e., by finding the appropriate "match" between available logical operations and occupational or scholastic expectations, the scale could serve as a practical tool not only for differential intellectual diagnosis, but also for predicting occupational and academic success.

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Cognitive Development as Explored by Piaget and its Impact upon Language Development

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I. FUNCTIONAL ANTECEDENTS AND THEIR IMPLICATIONS FOR LANGUAGE*

Principle	Nonverbal Behavior	Vocal/Verbal Behavior
Assimilation:	Incorporating objective reality into schemas.	Idiosyncratic aspects of verbal behavior; pronunciation, connotations, meaning.
1. Generalizing A.	Reflex actions; 1. stage of sensory-motor period.	Reacts to adult language with sounds from his own babbling repertoire; earliest forms of babbling.
2. Reciprocal A.	Combination of sight and prehension.	Reacts to a wide variety of sounds with babbling; recognizes mother's voice.
3. Recognitory A.	Motor recognition.	Greets familiar objects with babbling; enjoys 'babble-dialogues.'
4. Reproductive A.	Repetition of motor acts.	Repetition of sound and verbal productions; monologues babbling, word play.
Accommodation:	Changing schemas to fit objective reality.	Learning the rules of language; phonemes, pronour ciation, concepts, grammar.
Circular Reactions/ Feedback Processes:	Affecting environment and adapting to external stimuli.	Vocal/verbal activity and reactivity to feedback; 'babble dialogues,' mother-child conversation.
1. Primary c.r.	Repetition of acts for the sake of repetition.	Babbling/speaking without communicative intent; babbling in the crib, 'monologues' of child.
2. Secondary c.r.	Repetition with attention to results.	Vocal play with interest in sound forms; babbling is influenced by adult feedback.
3. Tertiary c.r.	Repetition with variation.	Intentional variation in vocal activity; later stages of babbling, 'Language in the Crib' (Weig, 1962).
Classification: "mobile schemas":	Practical or sensory-motor conceptualizations.	All words besides proper names, word classes: nouns, verbs, etc. Pivot + open class.
Discrimination:	Cause of accommodation, recognitory assimilation.	Specific reaction to sound complexes: words, tone of voice; acquisition of phonemes, recognition of mother's voice.
Functional Equivalence:	Generalizing assimilation, reciprocal assimilation. Motor recognition, 'ostensive definitions' = pointing.	Vocal/verbal expression of needs, understanding signal-value of voice, forming of word classes; knows mother's voice "means" feeding, meaningful use of words, class of nouns, etc.
Representation:	Imitation, play, pretending.	'Calling' - function of crying, acquisition of semeiotic function; meaningful cry or sounds, onomatopoetic words, adult vocabulary.
Tranformations:	Size and form constancies, reaching adapted to spatial exigencies, flexible coordination of secondary schemas.	Base structure or kernel sentences, transformations leading to surface structure. Transformations from active to passive, to questions, etc.
Communications:	Information exchange with environment.	Vocal/verbal exchange with other persons.
a) Aliment:	Information intake + accommodation.	Adapting babbling to phoneme structure of language. Referential use of language.
b) Efficacy:	Affecting the environment + accommodation.	Inducing adults to use baby talk, directive use of language.

*The numbered items are arranged approximately in developmental sequence. Item one being the most primordial and elementary. In several instances no final evidence concerning the exact developmental sequence exists.

II. SEMANTIC ANTECEDENTS AND THEIR IMPLICATIONS FOR LANGUAGE

Primacy of meaning: Meaning precedes objects in perception, is based upon instinctual/inborn relationship with the social and objective environment and expressed partly in inborn reflexes and emotional reactions. During the sensory-motor stage meaning becomes more differentiated: Object concept, distinction between humans and objects, concept of space, time, and causality. All three based upon sensory-motor interactions with the environment. Interactions lead to a concept of 'activity,' which is later expressed generally in verbs. 'Recognitory assimilation' as evidence of meaning. Meaning is the basis of verbal communication, as language is only a code for the transmission of meaning.

Specific concepts:

Principle	Nonverbal Evidence	Vocal/Verbal Evidence
1. Human Beings	Meaningfulness partly inborn in the form of the sucking reflex, rooting reflex towards nipple. Visual preference for the pattern of the human face; recognition of parents, recognitory smile upon recognition of parents.	"baba," "mama," proper names.
2. Object Concept	Searching for vanished object, return to temporarily abandoned object.	Pointing with sound production, nouns, pronouns.
3. Qualifiers	Basic for accommodation to various characteristics of objects; recognitory assimilation; understanding of constancy of object in spite of changing appearance.	Intonations, exclamations, adjectives, possessive pronouns.
4. Causality	Efficacy and phenomenalism; development of means-ends sequences (st.4), other people seen as causal centers (st.5), inference of cause from effect (st.6).	Causes expressed mainly through verb in the beginning; later verb-object or subject-verb-object; prepositional phrases.
5. Space and Time	Practical, subjective, and objective space; before-after in action-result sequence; from subjective to objective temporal series; seriation of events.	Spatial and temporal adverbs, prepositional phrases.
General Categories:		
1. Expressive	Vocal, facial, gestural expression of feelings; becoming diversified.	Change in forms of crying; intonation, adjectives, exclamations.
2. Directive	Means-ends sequences with intentionality; demands in form of crying or pointing.	Demand crying, whining, intonation, verbal imperatives "gimme"; possessive pronouns "mine."
3 Referential	Recognitory assimilation, contemplative recognition, 'ostensive definition' - pointing.	Vocabulary increasing rapidly.
Multiple channels for the expression of meanings	Crying, facial expression, gestures, large variety of nonverbal symbols.	Types of crying, paralinguistic phenomena of communication; accompaniment of language with gestures, verbal communication.

III. STRUCTURAL ANTECEDENTS AND THEIR IMPLICATIONS FOR LANGUAGE

Principle	Nonverbal Evidence	Vocal/Verbal Evidence
Schemas	Reflex schemas and their change through accommodation; schemas are interiorized coordinating or transformational actions; schemas as cognitive structures, an organized disposition, 'mobile frames' successively applied to various contents; accommodate to things (adapt and change their structure to fit reality while assimilating them.	Babbling-reduplicated syllables. Interiorized rules of language; language rules are cognitive structures, which are flexible and can be applied to many contents; partial distortion of reality through language frame.
	Schemas are forever extending their field of application so as to assimilate new and different objects.	Enlarging vocabulary of child and 'generativity' of language.
	Schemas undergo internal differentiation.	Holophrases differentiated into more-word sentences.
	Characteristics of schemas:	
	1. Repetition	Babbling patterns, word games.
	2. Generalization	Sentence frame generalized.
	3 Differentiation-recognition	Basis of communication.
	Coordination of schemas and their application to new situations between 8 & 12 mos.	Coordination of words into more-word sentences; 'generativity' of language between 18 & 24 months.
Elementary Schemas	Reflexes, perceptual schemas at birth;	Crying patterns, recognitory babbling.
	Developing into action schemas	Verbs
	Developing into recognition schemas	Nouns, pronouns.
Complex Schemas	Complete act	Sentence; holophrasis or more-word sentence.
	Operation - Object	Pivot - open construction.
	Action - Object	Verb - noun construction.
	Object - Object (relationship in space)	Noun - noun construction.
	Qualifier - Object	Adjective (possessive pronoun) - noun construction.
	Agent - Action	Noun (pronoun) - verb construction.
	Agent - Action - Object	Noun (pronoun) - verb - noun pronoun construction.
	Coordination of schemas	Coordination and subordination of clauses.
	Orienting reflex or exploration	Question.
	Recognition	Affirmative sentence "It is a . . ."
	Awareness of being the recipient of an action	Passive sentence.

Conclusions:

1. Most of the profound and pervasive principles of cognitive development, as they were explored by Piaget, appear to apply also to language development.

2. All known principles of language performance can be explained by the more general principles of cognitive development. Language development can, therefore, be understood as an epigenetic process arising from lower level antecedents.

3. As the principles of language development are known to a large part, it should be relatively soon feasible to design a functional and successful language teaching program based upon these principles. What remains to be done is a stepwise operationalization of these principles.

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Orientation to the University Affiliated Training Program
Childrens Hospital of Los Angeles

This University Affiliated Program is one of 30 similar programs throughout the United States. The UAP at Childrens Hospital of Los Angeles is funded by grant (MCH Project #914) from Maternal and Child Health Services, and Developmental Disabilities, Department of Health, Education and Welfare, and a special project training grant from the U.S. Office of Education, Bureau for the Education of the Handicapped. It is located on the campus of Childrens Hospital of Los Angeles, with Administrative Offices located four blocks south of the main hospital. Dr. Wylda Hammond is the Director. Training and clinical practice is provided both in the Hospital and in its Rehabilitation Center as well as in the Community.

Our primary affiliation is with the University of Southern California. Affiliations include the University of California at Los Angeles, California State University, Loma Linda University, Veterans Administration Hospital, Stanford University, University of California at Santa Barbara, and others.

The philosophic base of both our service and training programs is that multi-handicapping conditions are of such psycho-social-biological complexity that the knowledge and skills of many disciplines are required in order to implement a resolution. We presume that quality and creative service are essential to the training base.

Training Goals:

(1) To train professionals to work with the multi-handicapped, their families, and with the community in its broadest sense;

(2) To increase knowledge of professionals for each other, including what they do or don't do and can and can't do;

(3) To aid trainees in one discipline to develop skills applicable to their functioning from other disciplines, through team functioning;

(4) To train professionals to effectively collaborate with each other in an interdisciplinary process;

(5) To train professional leaders who can stimulate and develop interdisciplinary programs of service, education and training.

Families and extended families are involved. Ethnic groups include Caucasian, Black, Mexican-American, Oriental, etc. Economically, our families range from those receiving public assistance through those with incomes of $15,000 per year or more. Most major religions are represented. Problem areas include those with organic and non-organic etiologies as well as combinations of these. We stress social adjustment and social functioning related to multi-handicapping conditions. There are no restrictions as to race, sex, religion or socio-economic factors.

The following fields are represented on the staff and/or in the student population at the University Affiliated Program: administration, clinical psychology, communicative disorders, dentistry, education, nursing, nutrition, occupational therapy, pediatrics, physical therapy, psychiatry, school psychology, social work, and special education.

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